Decarbonising tourism: the transformation barriers to climate neutrality in accommodations –the case of Bavaria, southern Germany

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Decarbonising Tourism: The Transformation Barriers to Climate Neutrality in Accommodations – the Case of Bavaria, Southern Germany

Dekarbonisierung des Tourismus: Die Hemmnisse der Transformation zu Klimaneutralität in Beherbergungsbetrieben – das Beispiel Bayern

Abstract: The accommodation sector significantly contributes to greenhouse gas emissions in tourism. Likewise, climate change affects tourism and will do so even more in the future. The prospective climate impacts of greenhouse gas emissions from the accommodation industry depend on the industry itself, as the progression of climate change can be mitigated by climate-neutral accommodation. Furthermore, legislation requires businesses to achieve climate neutrality soon: In the EU by 2050, in Germany by 2045, and in the state of Bavaria by 2040. Thus, the pursuit of climate neutrality should be a top priority for the industry. The goal – climate neutrality – appears clear and is politically predetermined, yet its implementation falters.

This article analyses the barriers to achieving a climate-neutral accommodation sector in Bavaria using a socio-ecological transformation framework. Barriers to transformation were identified through qualitative interviews (n=26) and quantified via a standardised survey (n=666). The results show that many accommodation providers need to catch up on climate neutrality transformation, with expected costs, uncertainty, insecurity and lack of knowledge being central barriers. Furthermore, climate change receives limited attention and the responsibility for achieving climate neutrality is deflected to others.

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Zusammenfassung: Das Beherbergungswesen hat einen erheblichen Anteil an den im Tourismus emittierten Treibhausgasen. Zugleich beeinflusst der Klimawandel den Tourismus und wird dies künftig weitaus stärker tun. Dabei hängt die Menge der im Beherbergungswesen ausgestoßenen Treibhausgase im Wesentlichen von der Branche selbst ab, da das Voranschreiten des Klimawandels durch klimaneutrale Unterkünfte gebremst werden kann. Darüber hinaus fordert die Gesetzeslage von den Unternehmen, bald Klimaneutralität zu erreichen: In der EU bis 2050, in Deutschland bis 2045 und in Bayern bis 2040. Entsprechend sollte das Streben nach Klimaneutralität für die Branche eine hohe Priorität haben. Das Ziel – Klimaneutralität – scheint klar und ist zudem politisch vorgegeben, doch seine Umsetzung stockt.

Dieser Beitrag analysiert die Hindernisse für das Erreichen eines klimaneutralen Beherbergungswesens in Bayern im Kontext von sozialökologischer Transformation. Die Transformationshindernisse wurden durch qualitative Interviews (n=26) identifiziert und anschließend durch eine standardisierte Umfrage (n=666) quantifiziert. Die Ergebnisse zeigen, dass viele Beherbergungsbetriebe bei der Transformation hin zu Klimaneutralität Nachholbedarf haben. Zentrale Hindernisse sind dabei die erwarteten Kosten, Unsicherheit, Ungewissheit und mangelndes Wissen. Darüber hinaus wird dem Klimawandel nur begrenzte Aufmerksamkeit zuteil und die Verantwortung für das Erreichen von Klimaneutralität wird vielfach auf andere abgewälzt.

Schlüsselwörter: Dekarbonisierung, Klimaneutraler Tourismus, Transformation, Beherbergungswesen, Transformationshemmnisse, Tourismus in Bayern

1 Introduction

Climate change is progressing. Global temperatures have risen by 1.2 °C since the pre-industrial age (IPCC 2021). The IPCC (2021) calls for halving greenhouse gas emissions by 2030 and phasing them out by 2050. Tourism must meet this target, accounting for 8 % of global greenhouse gas emissions in 2013 (Lenzen et al. 2018) and 8.8 % in 2019, with Germany having the fourth-highest tourism-related emissions (Sun et al. 2024). Accommodation accounts for around 20 % of tourism emissions (Matzarakis and Lohmann 2017; Walmsley 2011) and has significant material, environmental and climatological impacts. In this article, 'accommodation' refers to all tourist overnight lodging, irrespective of gastronomic offerings. Gössling et al. (2021) attribute

a 'significant proportion' of tourism-related greenhouse gas emissions to it. Gössling and Peeters (2015) estimate 14 kg of CO_2e per overnight stay, excluding catering services[1]. Examining considerably less carbon-intensive Thai homestays, Koiwanit and Filimonau (2021) calculate a carbon footprint of 0.32 kg CO_2e per guest night. Most accommodation emissions result from fossil fuel combustion and land-use changes (Lenzen et al. 2018). Expanding the perspective from climate impacts alone to overall environmental impacts, Filimonau et al. (2021) found that hotel construction accounts for around 24 % of hotel's total environmental impact, while Campos et al. (2024) demonstrate that 3-star hotels have the highest negative environmental impact per overnight guest. Focusing on climate issues again, the sharing economy – like hotels – has a significant carbon footprint, as Cheng et al. (2020) show with Airbnb.

Tourism's greenhouse gas emissions – and thus those of the accommodation sector – depend on two opposing factors, leading to overall growth despite improved emission intensities: the growing demand for tourism goods and services and their declining greenhouse gas intensity (Malik, Lan, and Lenzen 2016). However, demand is growing faster than the intensity is falling (Gössling, Humpe, and Sun 2024), resulting in a 3.3 % annual emissions increase during 2009–2013 (Lenzen et al. 2018). Though climate change is inevitable, the 2020s will be crucial in determining its consequences. Governments and societies increasingly understand the urgency of appropriate measures (Scott and Gössling 2022a) to mitigate global warming. However, Scott and Gössling (2022a) note that climate change and its management in tourism lack the attention required, which should stem from two motivations: first, tourism's responsibility (Ma and Kirilenko 2020) in the light of an increase in its greenhouse gas emissions contrasting with the necessary annual reduction of 3–6 % to avoid global temperatures to rise over 2 °C (Peeters and Dubois 2010). Second, the impact of climate change on investments, planning and demand in the industry (Ma and Krilenko 2020). Tourism is sensitive to climate change consequences and accommodations face rising costs if emissions are not reduced (Gössling and Lund-Durlacher 2021). Koens, Postma and Papp (2019) advocate for more attention to ecological problems in tourism, including obstacles to climate-friendly tourism. Aall and Koens (2019) call for addressing climate change challenges, as destinations are changing under its influence: for instance, Central Europe is expected to have climatic conditions currently 1000 km to the south by 2050 (Bastin et al. 2019).

However, tourism is unprepared for imminent decarbonisation and climate change challenges. Scott (2021, p. 12) notes that "the past 30 years has not prepared the [tourism] sector for the next 30 years of accelerating climate change impacts and

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1 Thus, approximately 1.4 million tons of CO_2e were emitted from about 100 million overnight stays by guests in Bavaria in 2023 (LfStat 2024a). This represents 1.6 % of Bavaria's 85.5 million tons of CO_2e emissions from that year (LfStat 2024b).

the transformation to a decarbonised global economy." Climate protection needs prioritisation and the transformation to climate-neutral tourism is mandatory, as reducing greenhouse gas emissions is required by governments and investors (Scott and Gössling 2022a).

The supply-side oriented tourism research on climate change in German-speaking countries has so far focused mainly on how climate change affects tourism providers (see also: Bischof, Bauer, and Schmude 2017). This article shifts perspective by analysing the role of accommodations in mitigating climate change. It aims to provide insights into the transformations and dynamics of tourism systems. This approach addresses calls for a stronger focus on core social challenges – such as climate change – in tourism science to gain significance beyond intradisciplinary discourses (Bramwell et al. 2017). Becken and Loehr (2022) see far-reaching changes in tourism as essential to enable the transformation to a post-fossil economy, reducing climate risks for tourism. If conditions remain unchanged, tourism is expected to consume 40 % of the global CO_2 budget for the 1.5 °C target by 2050 (Gössling et al. 2023). Yet, the accommodation industry can become climate-neutral by 2050; for Austria, Gössling and Lund-Durlacher (2021) estimate this to be possible until 2040.

The need to respond to climate change is generally accepted in tourism. Knowledge exists (Loehr and Becken 2021) but implementation is problematic. Thus, it remains unclear which path to climate neutrality will lead to climate-neutral tourism (Gössling and Scott 2018). Gössling (2021) summarises that awareness of climate issues has increased, goals are clear, and action must follow. Though Sharpley (2020) calls for bridging the gap between theoretical knowledge and actual measures, application-oriented research results have not been implemented yet (Scott and Gössling 2022b). The question is: Why? The objective of this contribution is therefore to identify barriers to implementing effective climate change mitigation and decarbonisation measures in tourism, focusing on the accommodation sector in Bavaria. It adopts an application-oriented approach, as the question of what barriers need to be removed for accommodations to become climate-neutral is important beyond the academic discourse.

2 Current state of research

2.1 Bavarian context

By law, the EU must achieve climate neutrality by 2050. Germany aims for climate neutrality by 2045, and its largest state of Bavaria by 2040, established in Art. 2 § 2 of the BayKlimaG (Bavarian Climate Change Act). The Bavarian law is even more

ambitious than German and EU law and is obligatory for individuals and corporate entities in Bavaria. Despite the Bavarian government indicating in autumn 2024 that climate neutrality might not be achieved until 2045 (Süddeutsche Zeitung 2025), this does not affect the BayKlimaG obligations. Given this target, the decarbonisation of the accommodation sector in Bavaria might be advanced or at least in progress. This article therefore focuses on the decarbonisation of the Bavarian accommodation sector.

Tourism is a key economic sector in Bavaria (Pillmayer and Eberhardt 2024). In 2023, Bavarian accommodations registered over 100 250 000 overnight stays (LfStat 2024a), and about 38.9 million arrivals, over 21 % of Germany's total (StMELF 2024). Tourists spent about 47.5 billion Euros annually in Bavaria, employing 548 400 people (Bayern Tourismus Marketing GmbH 2024), making it the top employer. Of the 618 063 guest beds, 43.7 % are in hotels, 16.3 % in bed and breakfasts, 13.2 % in holiday homes and flats, 9.4 % in inns, 5.2 % in recreation and holiday homes, training centres, 4.9 % in guesthouses and 7.3 % in other accommodations, plus 532 open campsites (LfStat 2024c).

2.2 Climate neutrality and decarbonisation in tourism

The terms 'climate neutrality', 'carbon neutrality' and 'net-zero emissions' are often used interchangeably but differ significantly. To clarify the terminology: A climate-neutral society or economy has no net impact on the Earth's climate systems by emitting climate-impacting gases (e. g. CO_2, CH_4, N_2O). The concept of carbon neutrality is narrower, meaning that no CO_2 is emitted. The term 'net-zero emissions' is sometimes used instead of climate-neutral, but is criticised for lacking precision, as its understanding differs depending on the source (Rogelj et al. 2021). Decarbonisation describes a procedural approach to achieving climate neutrality (Wimbadi and Djalante 2020). This typically involves gradually reducing emissions of climate-impacting gases in energy production, industry and transport to net zero. Climate neutrality can also be achieved by offsetting emissions, e. g. through compensation.

Decarbonising the economy is one of history's most influential transformations (Scott and Gössling 2022a). Consequently, there is great scientific interest in the interconnections between the accommodation sector, climate change and decarbonisation. Extensive knowledge exists about fossil fuel consumption in this sector. Energy consumption varies by accommodation type, category and services (Filimonau et al. 2011). Greater convenience in hotels (Filimonau et al., 2021), hotel star ratings and occupancy rates (Gössling and Lund-Durlacher 2021) correlate positively with energy consumption. According to MacAskill, Becken and Coghlan (2023), hotel water consumption correlates significantly with occupancy rates, while

energy consumption correlates moderately; Koiwanit and Filimonau (2021) show that guest behaviour significantly influences the carbon footprint of accommodations. However, higher-class hotels are more likely to implement energy efficiency measures (Ali et al. 2008), though most businesses favour low-cost and low-disruption options to reduce greenhouse gas emissions (Coles, Zschiegner and Dinan 2013). Dhanda (2014) notes that claims about climate-neutral businesses are often exaggerated and illegitimate. Moreover, carbon offset programmes do not always achieve the desired climate mitigation effect, increasing the 'guilt-free' resource consumption by 5.4–15.5 % (Günther et al. 2020), though this effect can be diminished through real-time feedback to guests. Findings on internal greenhouse gas emissions vary slightly. Koiwanit and Filimonau (2021) and Ali et al. (2008) identify lighting and air conditioning as the largest sources. In hotels, catering (Filimonau et al. 2011) and laundry, both in-house and external, are also significant sources (Koiwanit and Filimonau 2021). Building age does not significantly affect mitigation efforts (Coles, Dinan, and Warren, 2015). Thus, older properties can also adopt renewable energy technologies.

Many businesses use energy-saving measures (Wu et al. 2022) and data-based energy management (Tims, Bajzelj, and Painuly 2021) to reduce greenhouse gas emissions. Smart technologies (IoT technologies, predictive maintenance, smart systems for heating, ventilation, and air conditioning) can increase efficiency and reduce costs (Karvounidi, Alexandropoulou, and Fousteris 2024). However, improved technologies have so far fallen short of expectations (Lenzen et al. 2018; Sun, Lin, and Higham 2020). Energy-saving and climate protection measures are often economically viable (Goffi, Cucculelli, and Masiero 2019; Gössling and Lund-Durlacher 2021), at least in the medium to long term (Hassanli and Ashwell 2020). Decarbonisation efforts improve business reputation and promote local environmental and economic resilience (Walmsley 2011). However, there is no universal strategy for reducing resource consumption and greenhouse gas emissions for all accommodation establishments (MacAskill, Becken, and Coghlan 2023). Besides energy-saving measures, better insulation (Ali et al. 2008), environmental awareness campaigns (Gössling and Lund-Durlacher 2021) and training programmes for employees (Appiah, Adongo, and Safo 2023) are recommended. Effective emission reduction requires fundamental changes, such as new business models (Gössling, Humpe, and Sun 2024) or policy and management interventions (Gössling and Lund-Durlacher 2021), as management commitment is crucial for decarbonisation.

The demand side also influences the pace and scope of decarbonisation in the accommodation sector. Travellers are increasingly concerned about climate responsibility, and climate-friendly behaviour is gaining legitimacy and aligning with travellers' values (Hassanli and Ashwell 2020), though this does not necessarily translate into an acceptance for potentially higher prices. Generations Y and Z

show environmentally and travel-savvy behaviour, and are willing to spend more on climate-friendly options (Zimmer et al. 2022). Destinations might differentiate themselves by offering climate-friendly options at (approximately) the same price, with most tourism stakeholders and tourists supporting decarbonisation measures (Mailer et al. 2019). The local social, political and economic context influences the decarbonisation of accommodation providers (Mota, Leite, and Ghasemi 2024). For example, public-private cooperations advanced renewable energies and sustainability knowledge in Mauritius and the Seychelles (Welton and Smith 2020).

Only few studies address climate neutrality barriers in the accommodation sector. According to them, a lack of planning and regulation inhibits the sector's decarbonisation (Dhanda 2014; Scott and Gössling 2022a). Existing regulations often fail to address the sector's realities (Coles, Zschiegner, and Dinan 2013), as one-size-fits-all policies do not drive mitigation efforts (Coles, Zschiegner, and Dinan 2014). Confusion or ignorance regarding funding opportunities and incentives are common (Coles, Zschiegner, and Dinan 2013). Warren and Becken (2017) note that the non-hotel sector remains unexplored in terms of decarbonisation barriers. A review on environmental sustainability in rural tourism indicates that barriers to transformation are omitted in the tourism literature (Madanaguli et al. 2023), necessitating research into effective strategies for overcoming decarbonisation barriers in tourism.

2.3 Transformation and transformation barriers

Transformation is commonly apprehended as an abstract concept describing large-scale changes. In this contribution, the concept of transformation is used analytically to facilitate the identification and examination of barriers to such large-scale changes that emerge from the interaction between politics, tourism, society, science and the environment (Heyen et al. 2018), specifically with the goal of achieving climate-neutral and economically successful tourism. Transformation often implies radical, normatively guided and teleological change (Bruns 2022), unfolding as a multi-scalar, emergent process (O'Brien 2012).

Transformation research has produced many theories (Feola 2015) on the drivers and barriers of transformation processes. Key drivers include innovations, future visions (Folke et al. 2021) and crises (Kristof 2020). Crises facilitate rapid resources accumulation, decision-making and political support, which can be used in transformative or anti-transformative ways, i. e. to stabilise systems (Agostino, Arnaboldi, and Diaz Lema 2021). Crisis management strategies can help systems overcome path dependencies, abandon previous development paths and undergo alternative developments. Development paths often shift abruptly through 'windows of opportunity' (Olsson et al. 2006).

Other drivers of sustainability transformations are financial incentives and promoting research and development (Mazzucato and Kettel 2020). Appropriate infrastructures, capacity building and tailored tools are necessary. Higgins-Desbiolles (2006) hopes tourism can positively contribute to socio-ecological transformation. However, it is unclear if that transformation will be incremental or radical, depending on tourism stakeholders' willingness to change and political regulations. Peeters and Dubois (2010) believe that without radical transformation, a significant reduction of tourism's greenhouse gas emissions is virtually impossible. The same applies to meeting the 2050 Paris Agreement's climate targets. Scott and Gössling (2022a) point out that sustainable tourism requires appropriate change and demand alignment.

Achieving climate neutrality in tourism is politically, socially and economically challenging (Peeters and Papp 2024) and faces various barriers, categorised as fundamental and tourism-specific by the authors (for an overview, see table 1). Fundamental obstacles stem from the basic structures and mechanisms of transformation processes effective in many contexts including tourism and accommodation. In contrast, the literature review showed that tourism-specific barriers are characterised by diverse discursive and material conditions in the sector, limiting generalisation.

Table 1: Transformation barriers derived from the literature

Fundamental barriers	Tourism-specific barriers
Structural path dependencies and lock-ins	Economic-only success metrics
Diverging interests, power conflicts	Conflicting tourism policy interests
Resistance due to uncertainty/fear of loss	Lobbying
Lack of societal consent and involvement	Lack of political will
Stifling actors, competing visions/goals	National-local implementation gap
Communication and transparency issues	Feasibility concerns
Short-term growth paradigm	Maladaptiation risks
Lack of knowledge about transformation dynamics	Poor internalisation of carbon and climate risks for tourism
Emergence of transformation processes	Lack of resources and knowledge at operational levels
Complex interdependencies across technological, infrastructural, economic, organisational, institutional, legal structures	Varying awareness, understanding and commitment among stakeholders
	Conflicting investment incentives and subsidy systems
	Reactive rather than proactive strategies

Widespread fundamental barriers to transformation include strong structural path dependencies and lock-ins (Schilcher 2007) and diverging interests and power, causing some actors to resist change to preserve the status quo (Heyen et al. 2018). Critics of transformation often experience resistance due to uncertainty or fear of

loss (UBA 2023). The success of transformation depends on the consent, participation and involvement of the majority of society and economy, requiring a consensus on the necessity, goals, measures and timing of transformation (Jacob et al. 2019). Stifling actors (Kristof 2020), competing visions and goals, and different resources and interests make cooperation difficult (Jacob et al. 2019). Therefore, communication and transparency are significant factors influencing action and important for implementing transformation (UBA 2023).

In addition to actor-specific obstacles, the role of time, reflected in political windows of opportunity, must be considered (Jacob et al. 2019). A short-term growth paradigm dominates the economy today, especially tourism (Hall 2009), preventing long-term transformations. Path dependencies are difficult to overcome (Kristof 2020), reflected in complex technological, infrastructural, economic, user- and organisation-related, institutional and legal structures (Heyen et al. 2018). Due to the interconnection of elements and specialised structures, transformation difficulties arise when changing or creating them (Clausen and Fichter 2016). Hence, past decisions hinder future actions, with feedback and self-reinforcement effects.

The interplay of technological, socioeconomic and ecological developments makes transformation complex and uncertain. Interdependencies and co-evolution occur within and between systems (Jacob et al. 2019). Additionally, there is often a lack of knowledge regarding transformation dynamics and directions. Therefore, cause-and-effect relationships and the consequences of change are hard to predict. This emergence reflects that although transformations can be designed in a goal-oriented manner, their course and outcome cannot be fully planned and foreseen, leading to uncertainty (Grießhammer and Brohmann 2015).

Several tourism-specific factors, alongside fundamental barriers, slow down transformations in the sector. The necessary changes are embedded in larger systems and influenced by numerous factors, impairing the transformation process. Thus, industry structures and logics, like the strong focus on growth or assessing 'successful' tourism based solely on economic indicators, hinder a transformation towards climate neutrality (Becken and Loehr 2022; Dickinson, Robbins, and Lumsdon 2010; Hall 2009). Conflicting tourism policy interests, investment incentives, subsidy systems and lobbying obstruct climate neutrality (Gössling, Fichert, and Forsyth 2017). Similarly, institutional barriers, lack of political will and a gap between national climate protection declarations and locally feasible measures hinder entrepreneurial strategies and economic conditions for transformation (Kaján and Saarinen 2013). Further barriers like feasibility, unknown costs, uncertain time window and maladaptation risk (Adger and Barnett 2009), as well as lack of resources and knowledge (Chin et al. 2019) exist. Consequently, effective decarbonisation requires overcoming financial, political and technical barriers (Gössling et al. 2023). The presumed high costs of climate protection in

the accommodation sector are identified as a barrier (Appiah, Adongo, and Safo 2023; Hassanli and Ashwell 2020). Furthermore, the information base for implementing climate neutrality measures through energy savings is incomplete. Research on climate change and tourism began to grow only in the late 2000s (Scott 2021). Today's challenges in tourism are partly explained by the late start of research (Njoroge 2015). This concerns scientific knowledge, availability of emission values in businesses, where information is often lacking or not shared (Lalicic and Önder 2018), and individual knowledge on the operational level (Hassanli and Ashwell 2020).

The lack of solid knowledge prevents evidence-based collective action (Scott 2021). Uncertainty about future changes exists (Adger and Barnett 2009), leading to a lack of country or destination-specific information and a credible climate protection plan with realisable strategies. Global tourism representatives have not fully internalised the carbon and climate risks and the need for concrete climate neutrality and protection strategies (Kaján and Saarinen 2013). Accordingly, tourism operators vary in their recognition of climate change. Some see it as a potential future problem, leading to little willingness for short-term initiatives – and if action is taken, it tends to be reactive, though proactive strategies are necessary, especially in sensitive regions (Chin et al. 2019). There are varying levels of awareness, understanding, scepticism and commitment among stakeholders in responding to climate change (Njoroge 2015).

As the literature review shows, several drivers and barriers can influence tourism transformation. Although extensive literature analyses current mitigation efforts in tourist accommodations (see 2.2), it remains largely unclear why the sector is making limited progress in decarbonisation, despite Gössling et al. (2023) indicating it should be relatively easy, compared to other tourism segments. This article addresses this issue.

3 Methodology and sample description

Due to limited knowledge on the subject, an exploratory, primarily inductive research design was chosen. The study used a sequential mixed-methods approach to utilise the advantages of qualitative and quantitative survey methods while avoiding their weaknesses (Kuckartz 2014). The first step consisted of qualitative, guided interviews (3.1) serving as a pre-study. Its findings were quantified in a subsequent online questionnaire survey (3.2).

3.1 Qualitative, guided interviews

The qualitative, guided interviews (Dunn 2021) were conducted between February and July 2023 and identified barriers to the climate-neutral transformation of tourism in Bavaria. Only accommodation sector stakeholders were interviewed, selected through theoretical sampling (Strübing 2013). The interviews first discussed the operational situation, climate change awareness and climate protection relevance within businesses. Then, the interviews proceeded individually and covered potential plans for achieving climate neutrality, challenges, barriers and implemented measures. All interviewees were familiar with the terms 'climate neutrality' and 'climate protection' and could differentiate them, eliminating any conceptual confusion or miscommunication. The frequency of barrier mentions was secondary, as this initial collection was compiled without prioritisation. This first empirical part involved 26 interviews (average length: 32 minutes), 15 in Augsburg and eleven in the Allgäu region. Table 2 lists the anonymised interview partners. Theoretical saturation (Morse 2004) was reached after 19 interviews, and a few more were conducted to confirm it. All interviews were held in German, audio recorded and transcribed verbatim. The analysis used qualitative content analysis (Kuckartz and Rädiker 2022) in MAXQDA.

Table 2: Interview partners of qualitative interviews

Code	Type of Accommodation	Size	Location
I1	Hotel	220 Rooms	Augsburg
I2	Guesthouse	24 Rooms	Augsburg
I3	Hotel	30 Rooms	Augsburg
I4	Hotel	20 Rooms	Augsburg
I5	Hotel	83 Rooms, 215 Beds	Augsburg
I6	Hotel	111 Rooms, 230 Beds	Augsburg
I7	Hotel	25 Rooms	Augsburg
I8	Hotel	235 Rooms, 510 Beds	Augsburg
I9	Hotel	31 Rooms	Augsburg
I10	Hotel	132 Rooms	Augsburg
I11	Inn	21 Rooms	Augsburg
I12	Youth hostel	19 Rooms	Augsburg
I13	Inn	12 Rooms	Augsburg
I14	Hotel	20 Rooms	Oberstdorf
I15	Hotel	60 Rooms	Fischen
I16	Campsite	50 Caravan sites, 20 Tent pitches	Allgäu
I17	Hotel	ca. 180 Rooms	Augsburg
I18	Hotel	73 Rooms	Augsburg
I19	Campsite	ca. 50 Caravan sites, 20 Tent pitches	Allgäu

Table 2: (continued)

Code	Type of Accommodation	Size	Location
I20	Campsite	25 Caravan sites	Allgäu
I21	Holiday flats	n/a	Oberstdorf
I22	Farm	3 Rooms	Immenstadt
I23	Campsite	50 Pitches	Allgäu
I24	Hotel	18 Rooms	Immenstadt
I25	Holiday flats and homes	4 Holiday flats, 5 Holiday homes	Oberstdorf
I26	Holiday flats, Campsite	3 Holiday flats, 80 Caravan sites	Oberjoch

The decision to conduct qualitative interviews in Augsburg and the Allgäu region was based on theoretical and logistical considerations. The interviews aimed for a wide range of positions, not statistical representation. To enable this, two differently structured tourism destinations were selected. The city of Augsburg (300 000 inhabitants) is located in Southwest Bavaria, 60 km northwest of Munich. It is an urban destination with 1.13 million overnight stays in 2023 (LfStat 2024a). Most holiday guests visit for its history, cultural heritage and architecture. In contrast, the Allgäu region is a rural destination, offering nature-based attractions. It refers to a vaguely defined, alpine, pre-alpine and plain region in southwest Bavaria. The southeast of Baden-Württemberg is sometimes included but omitted in this article, as it is not subject to the BayKlimaG. The Allgäu region comprises the districts Oberallgäu, Unterallgäu, Ostallgäu and Lindau and the cities of Kempten, Kaufbeuren and Memmingen. It is one of Germany's most important tourist regions, attracting day trippers and holiday guests. In 2023, the Bavarian Allgäu (around 685 000 inhabitants) recorded around 13.31 million overnight stays (LfStat 2024a). The authors' preexisting contextual knowledge favoured the selected destinations. It was easier to contextualise and interpret the interview statements related to places, local political figures or examples.

3.2 Quantitative, standardised interviews

In January and February 2024, a quantitative survey was conducted using ESRI's Survey123 online survey tool, building on the barriers to transformation identified in the qualitative interviews. The survey targeted accommodation providers across Bavaria to categorise the identified obstacles by influence and prevalence. Before the survey, the questionnaire was pretested with selected establishments and adjusted based on their feedback. Invitations to participate were distributed via email by the Bavarian branch of the German Hotel and Restaurant Association (DEHOGA), the 'Blauer Gockel' ('blue cock'), the Bavarian association for farm and country holidays,

and regional and local DMOs. Participation was anonymous, voluntary and not incentivised. Using DEHOGA, Blauer Gockel and DMOs to disseminate the questionnaire enhances data reliability and validity. Firstly, associations can affect higher response rates by leveraging their communication channels and legitimacy (Pechlaner, Volgger, and Herntrei 2012). Secondly, they can ensure comprehensive and accurate sampling through up-to-date membership lists. This approach reduces sampling bias, enhancing generalizability. Collaborating with these associations enables savings in time and financial resources, while facilitating dissemination across Bavaria.

The questionnaire used was structured as follows: First, respondents indicated how challenging they perceive their business situation (five-point ordinal scale from 'no challenges at all' to 'very serious challenges') and the specific challenges they face (multiple-choice). Then, respondents were asked about the impact of climate change on their business (single choice), the importance of climate protection to them personally (four-point ordinal scale from 'very important' to 'very unimportant') and whom they consider primarily responsible for climate protection in the accommodation sector (single choice). Subsequent items asked about accountability for climate protection in the establishments (and if so, whether as a main or secondary task), knowledge of the establishment's greenhouse gas emissions (single choice) and whether measures to reduce them had been taken (yes/no). If yes, respondents were asked which climate protection measures had been adopted (multiple answers with free text). This was followed by a yes/no filter question about climate neutrality as an in-house goal and, if so, the deadline (open question). Next, the 19 barriers to transformation identified in the qualitative interviews were queried. For each barrier, its impact on the establishment was assessed (six-point ordinal scale from 'fully applies' to 'does not apply at all'). After that, the accommodation type (multiple-choice), number of beds ('up to 20', '20–70', '71–150', 'over 150') or, for camping sites, the number of pitches (open question) and the district or district-free city (open question) were recorded. Lastly, a yes/no question asked whether the operator was also the owner and the business's operating concept (single choice). At the end, respondents could submit notes, questions and comments.

A total of 679 accommodation establishments participated in the survey. After excluding invalid cases, a sample size of n=666 remained (see Table 3). Participation intensity varied regionally compared to the actual administrative district proportion. Franconian and Swabian DMOs showed a high willingness to cooperate, yielding high response rates from these Bavarian districts. Accommodation providers from Upper Palatinate (sample share: 9.0 %), Upper Franconia (11.4 %), Central Franconia (15.5 %) and Swabia (27.4 %) are overrepresented (real shares: 7.4 %; 7.2 %; 8.3 % and 21.0 %), while those from Upper Bavaria (24.4 %) and Lower Bavaria (5.3 %) are underrepresented (real shares: 34.9 % and 13.6 %). Lower Franconia's establishments were well represented with a sample share of 7.0 % (real: 7.7 %).

Table 3: Accommodation types in the quantitative sample (multiple answers possible)

Type of accommodation establishment	Number of returns
Holiday apartments/houses/rooms	303
Hotels and bed and breakfast hotels	219
Inns	97
Farms	75
Guesthouses	48
Campsites	28
Youth hostels and huts	16
Recreation and holiday homes, training centres	5
Other accommodation	4

To assess sample representativeness, it is important to distinguish 1) accommodation establishments with 10 or more guest beds and campsites with 10 or more pitches and 2) smaller establishments, usually holiday flats and farms. Records show 10 822 open establishments in category 1) for December 2023 (LfStat 2024c). The drawn sample is representative at the confidence level α=.05 (margin of error 5 %). Those with nine or fewer beds are not statistically recorded, complicating the representativeness assessment for category 2). According to Bayern Tourismus Marketing GmbH (2022), 2999 holiday homes, flats, and rooms existed in Bavaria in 2021. Based on the sub-sample for holiday flats/houses/rooms of n=303, statistical representativeness (α=.05; margin of error 5 %) can be assumed here – although this assumption cannot be substantiated due to the poor data situation.

After the survey, the data was adjusted, formatted and statistically analysed via SPSS, primarily employing univariate and bivariate analysis methods. Furthermore, an exploratory factor analysis was used to determine if fewer factors could represent the transformation barriers identified. According to the Bartlett test (p<.001) and the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO=.861), the barrier variables were suitable for factor analysis. A principal component analysis with varimax rotation indicated four factors with eigenvalues greater than 1.0, explaining 62.99 % of the variables' variance. The correlations between group characteristics or differences were tested for potential influences of regional respondent proportions. No such influences were found.

4 Results

4.1 Overarching findings

First, some overarching findings regarding the current status of the climate-neutral accommodation sector are presented. As with the entire results section, the findings reported here synthesise insights from both the qualitative and quantitative surveys. When asked about climate change impact, 56.4 % of the accommodation companies state they were not affected. Slightly less than a third (30.1 %) feel negative effects, whereas 13.5 % state a positive impact, like a longer summer season. Nevertheless, all companies must achieve climate neutrality by 2040 under the BayKlimaG. However, only 40.0 % (n=262) claim they are pursuing this goal. Of these, 30 (4.5 % of all companies interviewed) claim to be already climate-neutral. The remaining 232 companies (34.8 %) want to achieve this in the next few years, whereas 166 companies (24.9 %) indicated specific years for achieving this goal (see Figure 1).
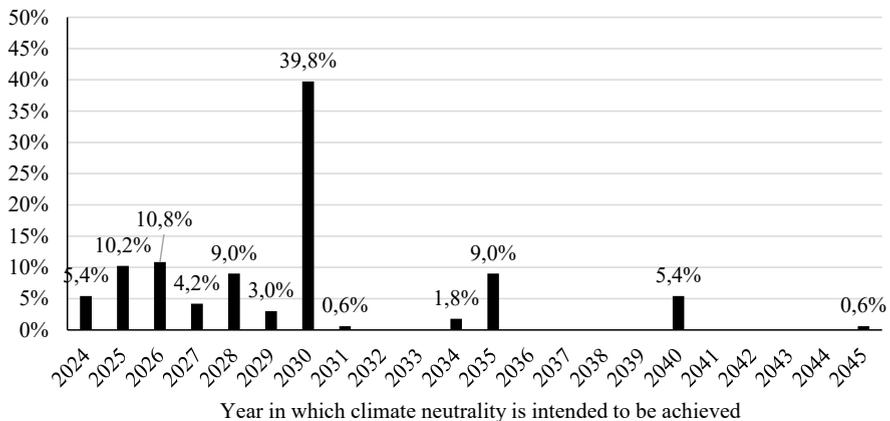

Figure 1: Target years for companies' climate neutrality
Note: Only includes companies pursuing climate neutrality

To achieve *true* net-zero emissions, a significant increase in offsetting greenhouse gas emissions is needed in the coming years. Currently, 27 companies (4.1 %) of all sizes and types practice this. Employee training (100 companies; 15.0 %) is also important, and more businesses should become aware of this.[2]

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[2] A clear distinction must be made between different types and sizes of accommodation establishments: 33.3 % of hotels provided staff training, compared to 11.3 % of guesthouses and 5.9 % of holiday flat, room or house landlords, who employ no staff to be trained.

In general, providers face multiple problems, with climate change ranking seventh out of twelve (see Figure 2). In particular, guests' unpredictable booking behaviour, the shortage of skilled workers, inflation, regulations and the economic situation were mentioned frequently. On average, respondents named over three challenges (mean: 3.16; median: 3; standard deviation: 2.175), with 81 businesses (12.2 %) reporting no challenges.

Given these challenges, climate change concerns are muted. Accommodation providers face acute challenges, leaving little attention to long-term climate neutrality plans. Such plans are pursued mainly in establishments whose management values climate protection (weak but highly significant difference; Cramer's V .343 at n=649; p<.001).

Many businesses' personnel policies reflect a lack of awareness of climate protection and neutrality responsibilities in the accommodation sector. Climate protection should be a continuous task with defined responsibilities but only 51.5 % of companies have at least one person responsible for climate protection as their main (5.7 %) or secondary (45.8 %) task. In contrast, 7.6 % of businesses lack responsible
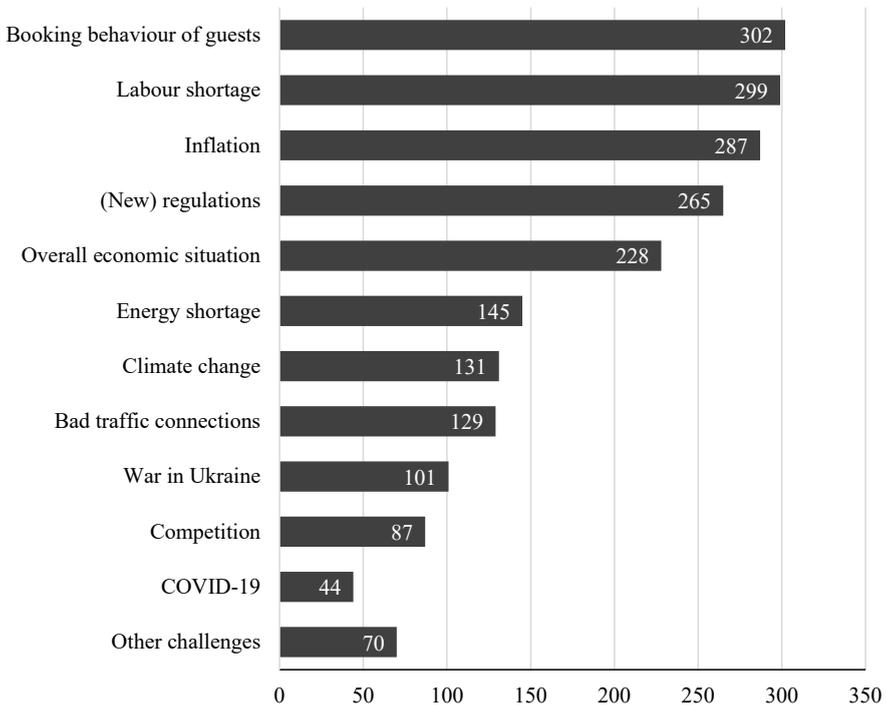

Challenge	Value
Booking behaviour of guests	302
Labour shortage	299
Inflation	287
(New) regulations	265
Overall economic situation	228
Energy shortage	145
Climate change	131
Bad traffic connections	129
War in Ukraine	101
Competition	87
COVID-19	44
Other challenges	70

Figure 2: Current challenges for accommodation providers
(multiple answers possible)

staff for climate protection and neutrality but plan to create such a position, while
40.8 % neither employ anybody for this task nor plan to.

4.2 Barriers to transformation in the accommodation sector

4.2.1 Overview of barriers

The qualitative interviews identified over 25 barriers to achieving climate neutral-
ity. In the subsequent quantitative survey, companies were asked about the extent
of their impact from these barriers. Since some barriers differed only marginally in
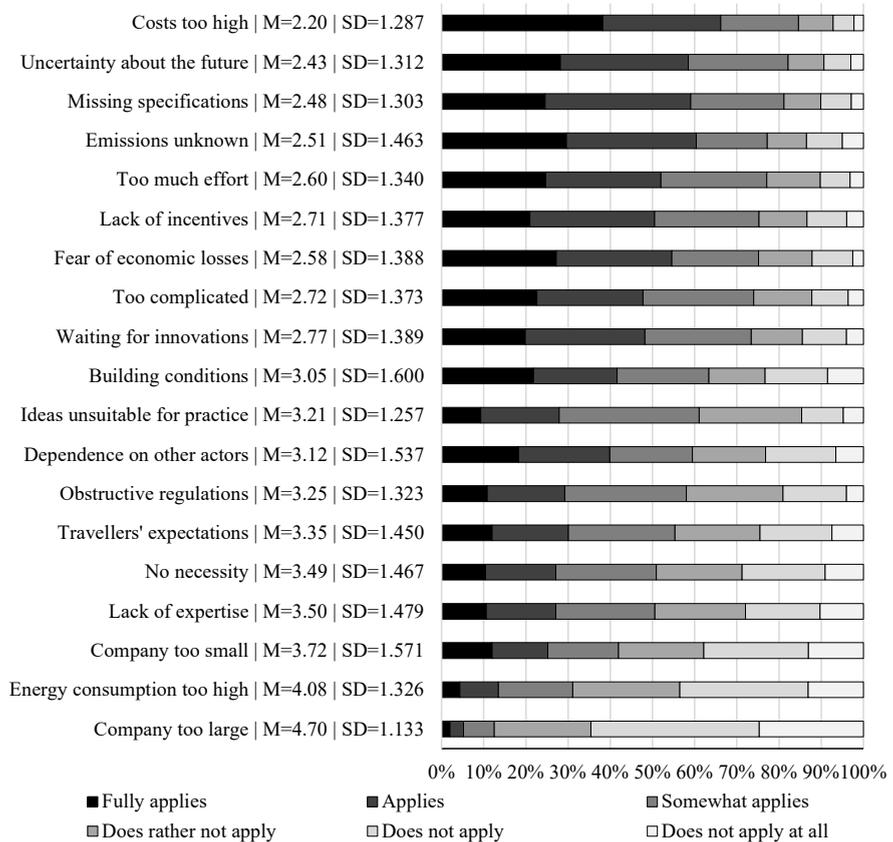content and wording, they were summarised based on pretest feedback. Eventually,

Figure 3: Obstacles affecting the companies

19 barriers were queried, and the possibility of adding further factors preventing decarbonisation was given via free text input (see Figure 3).

The barriers to transformation are listed by impact based on the aggregated proportion of indications that the barrier 'fully applies', 'applies' or 'somewhat applies'. The six most frequently mentioned barriers to climate neutrality are 1) too high costs 2) uncertain prospects 3) lack of guidelines and regulations 4) unknown business emissions 5) too much effort 6) lack of incentives.

Many listed obstacles correlate significantly, revealing a complex network of barriers to transformation. To structure this network, all 19 barriers were analysed using an exploratory factor analysis, revealing four factors that could represent most of the barriers. The four factors are 1) 'Inadequate cost-benefit ratio of decarbonisation'; 2) 'denial of responsibility and agency fuelled by uncertainties'; 3) 'lack of knowledge' and 4) 'business deemed too large'. Table 4 shows the summarised barriers.

The cross-loadings of the barriers 'lack of incentives' and 'missing specifications' indicate that factors 'inadequate cost-benefit ratio of decarbonisation' and 'denial of responsibility and agency fuelled by uncertainties' cannot be clearly separated. However, this solution is acceptable as these variables are meaningful in both factors. The transformation barriers 'ideas unsuitable for practice', 'travellers' expectations', 'building conditions', 'waiting for innovations' and 'fear of economic losses' were excluded from the factor analysis due to cross-loadings. The latter

Table 4: Factor analysis results of transformation barriers

	Factor			
Barrier	1	2	3	4
Too much effort	.717	.110	.117	.344
Company too small	.665	-.108	.340	.017
No necessity	.632	.259	-.067	-.034
Lack of incentives	.623	.475	.019	-.060
Costs too high	.617	.191	.338	.242
Too complicated	.604	.250	.384	.256
Dependence on other actors	-.058	.757	.114	.269
Obstructive regulations	.264	.709	.082	.089
Uncertainty about the future	.222	.666	.337	.134
Missing specifications	.464	.540	.137	-.125
Emissions unknown	.120	.097	.847	.008
Lack of expertise	.238	.329	.696	-.011
Company too large	-.011	.143	-.093	.837
Energy consumption too high	.225	.082	.124	.802
Percentage of variance explained by factors	21.1 %	16.9 %	12.8 %	12.2 %

barrier shows loadings >.2 for all factors and is effective across all. The exclusion of individual barriers does not indicate they are less influential in hindering climate neutrality; they just cannot be unambiguously aggregated with others.

Paragraphs 4.2.2 to 4.2.6 detail several transformation barriers based on their frequency in the quantitative survey and insights from qualitative interviews. Only medium to strong and significant correlations are described (correlation coefficient or difference measure >.5; significance level α=.05; see correlation matrix in Supplement 1).

4.2.2 Costs

A major barrier to climate neutrality is expected costs. Over 84 % of businesses cite 'costs' as a barrier. Accommodation providers must ensure investments in facilities, modernisations and conversions are economically viable. *'It is insanely*

Table 5: Mann-Whitney-U-test results on differences in the prevalence of barriers depending on an accommodation business's plans to become climate neutral (significant differences at α=.05 indicated by bolding; sorted from highest to lowest values of |z|)

				Mean values for barriers	
Barrier	n	z	p	pursue climate neutrality	do not pursue climate neutrality
No necessity	602	−9.827	**<.001**	4.22	3.03
Too much effort	563	−9.671	**<.001**	3.27	2.14
Too complicated	575	−9.301	**<.001**	3.37	2.29
Company too small	580	−8.734	**<.001**	4.41	3.26
Fear of economic losses	595	−8.013	**<.001**	3.15	2.22
Lack of expertise	601	−7.443	**<.001**	4.06	3.15
Building conditions	597	−6.658	**<.001**	3.59	2.71
Costs too high	581	−6.634	**<.001**	2.68	1.91
Emissions unknown	597	−5.983	**<.001**	3.00	2.21
Obstructive regulations	569	−5.904	**<.001**	3.66	2.99
Lack of incentives	604	−5.684	**<.001**	3.12	2.44
Missing specifications	591	−4.903	**<.001**	2.82	2.26
Uncertainty about the future	597	−4.798	**<.001**	2.80	2.20
Waiting for innovations	593	−4.719	**<.001**	3.14	2.54
Energy consumption too high	568	−4.153	**<.001**	4.39	3.88
Travellers' expectations	573	−2.764	**.006**	3.56	3.22
Dependence on other actors	581	−2.066	**.039**	3.30	3.02
Ideas unsuitable for practice	503	−1.920	.055	3.34	3.13
Company too large	557	.410	.682	4.70	4.71

expensive and sometimes simply unaffordable to buy CO_2-friendly or climate-friendly products' (I8). Companies citing 'too high costs' are significantly less likely to plan to become climate neutral (Mann-Whitney-U-test at n=581; highly significant difference; p<.001; see table 5). There is no significant difference in the assessment of how affected they are by climate change. Consequently, establishments citing 'too high costs' as a climate protection barrier consider themselves as affected by climate change as those for whom climate transformation costs are not a major issue. Medium to strong correlations exist between 'too high costs' and other transformation barriers, specifically with 'too much effort' (.646), 'too complicated' (.619), 'fear of economic losses' (.584) and 'waiting for innovations' (.528). All correlations are highly significant (p<.001), using Spearman's Rho.

Accommodation businesses facing cost barriers rate their situation highly significantly more often as a 'serious challenge' or 'very serious challenge' (weak, positive and highly significant correlation; Spearman's Rho .289 at n=585; p<.001). Significant challenges include (see table 6): '(new) regulations', 'overall economic situation', 'inflation', 'war in Ukraine', 'energy shortage', 'booking behaviour of guests' and 'COVID-19'. These companies have rarely implemented climate protection measures, lack knowledge about transformation costs, and face immediate challenges, leading to a lack of awareness of ecologically or climatologically sensible measures.

Table 6: Mann-Whitney-U-test results on the 'too high costs' barrier prevalence based on whether a challenge was regarded as affecting the business (significant differences at α=.05 indicated by bolding; sorted from highest to lowest values of |z|)

Challenge	n	z	p	Mean values for the 'too high costs' barrier	
				challenge applies	challenge does not apply
(New) regulations	586	–3.856	**<.001**	1.94	2.40
Inflation	586	–3.174	**.002**	1.98	2.38
War in Ukraine	586	–3.102	**.002**	1.79	2.28
Overall economic situation	586	–3.038	**.002**	1.94	2.35
Energy shortage	586	–2.861	**.004**	1.90	2.30
Booking behaviour of guests	586	–2.263	**.024**	2.06	2.33
COVID–19	586	–1.966	**.049**	1.83	2.23
Competition	586	–1.865	.062	1.95	2.24
Labour shortage	586	-.896	.370	2.11	2.29
Bad traffic connection	586	-.453	.651	2.21	2.20
Climate change	586	-.289	.772	2.12	2.22

4.2.3 Uncertainty, insecurity, ignorance

Many hosts are uncertain, insecure, and ignorant about achieving climate neutrality. Over 82 % of businesses cite 'uncertainty' as a barrier. Many have a vague understanding of climate change's impact on their business model and necessary changes. Planning security and long-term prospects are crucial for investments. However, there is a lack of knowledge: '*When I think of the new heating law, [...] there is a certain amount of uncertainty about what and how you are affected by it. Well, I can't imagine anything about it now*' (I25). Companies pursuing climate neutrality were significantly less likely to be hindered by future uncertainty (highly significant difference; p<.001; see table 5). Those with a clear plan are significantly more optimistic and can plan future measures. The pessimistic/optimistic view of the future is linked to the allocation of responsibilities within the company. Those with an uncertain future are less likely to have someone responsible for climate protection and to create such a position than companies with a predictable future (very weak but highly significant difference; Cramer's V .175 at n=594; p<.001).

Assessing the current situation as 'challenging' or 'very challenging' correlates with a significantly more uncertain future (weak, positive and highly significant correlation; Spearman's Rho=.203 at n=597; p<.001), similar to the barrier 'too high costs'. Table 7 shows challenges businesses face: '(new) regulations', 'inflation', 'war

Table 7: Mann-Whitney-U-test results on the prevalence of the barrier 'uncertainty about the future' based on whether a challenge was seen as affecting the business (significant differences at α=.05 indicated by bolding; sorted from highest to lowest values of |z|)

Challenge	n	z	p	Mean values for the 'uncertainty about the future' barrier	
				Challenge applies	Challenge does not apply
(New) regulations	600	–4.832	**<.001**	2.12	2.66
Inflation	600	–4.078	**<.001**	2.16	2.65
War in Ukraine	600	–3.849	**<.001**	1.97	2.52
Booking behaviour of guests	600	–2.548	**.011**	2.28	2.57
Energy shortage	600	–2.181	**.029**	2.21	2.50
Overall economic situation	600	–2.048	**.041**	2.27	2.53
COVID-19	600	–1.905	.057	2.10	2.46
Labour shortage	600	–1.485	.137	2.33	2.53
Bad traffic connection	600	–1.145	.252	2.30	2.47
Climate change	600	-.704	.481	2.34	2.46
Competition	600	-.675	.500	2.38	2.44

in Ukraine', 'booking behaviour of guests', 'energy shortage' and 'overall economic situation'. Thus, perceiving economic challenges often coincides with a pessimistic outlook, though causality direction is unclear.
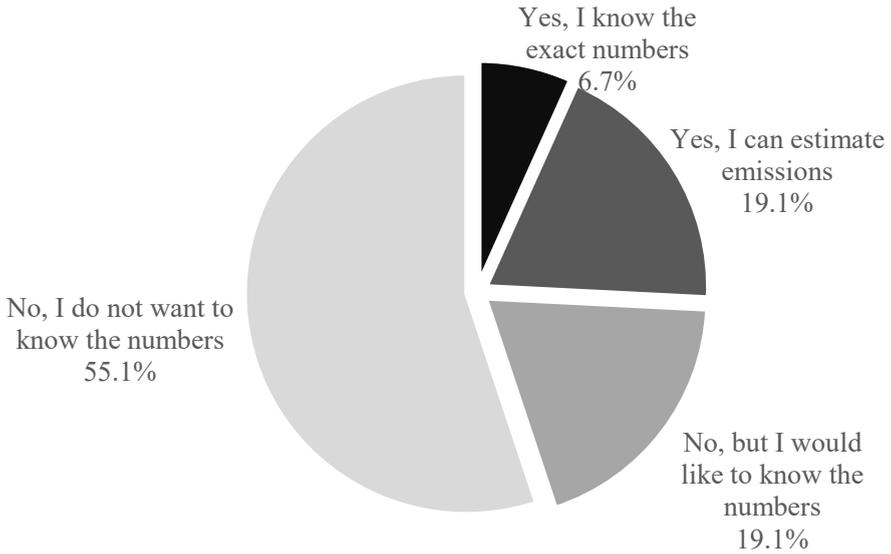

Figure 4: Knowledge of companies' emissions.

4.2.4 Emissions are unknown

Figure 4 shows that 6.7 % of businesses know their greenhouse gas emissions, while 74.2 % are unaware. Though it is necessary for reducing emissions, 55.1 % of companies do not want to know the figures. Without knowledge of the emissions to be saved or offset, reduction planning is difficult. Larger companies are more aware of operational emissions (p<.001), while small and micro businesses cannot estimate their emissions. In particular, owner-managed establishments avoid the presumed effort.

4.2.5 High effort

Becoming a climate-neutral accommodation establishment is seen as costly, as is the constant climate impact monitoring. A majority of companies (77.1 %) indicate that the high effort involved prevents them from achieving this. For instance, the

challenge with certification is that '*if you do the certification, you have to prove everything. You really have to calculate everything. You have to find out everything yourself*' (I3). However, this high effort is only indirectly reflected in the operating result and is – for now – a mainly voluntary task. High effort inhibits most accommodation establishments, except holiday flats (p=.003), which show great variability in its assessment. In the other types, mostly small companies with fewer than 20 beds shy away from the climate neutrality effort (significant difference at p=.04), often due to fear of economic losses (medium-strong, positive and highly significant correlation; Spearman's Rho=.563 at n=319; p<.001). Additionally, some establishments show signs of being overburdened: more challenges lead to avoidance of climate neutrality (highly significant correlation; p<.001). The barriers 'too much effort' and 'too complicated' correlate strongly positively (.627) and highly significantly (p<.001).

If a business considers climate protection as important, it will invest (weak but highly significant correlation; Cramer's V .259 at n=580; p<.001). Conversely, if it rates climate protection as less important, it is unlikely to invest effort. This is reflected in the responsibility question in the accommodation sector. Businesses citing high costs as barriers to climate neutrality often state 'nobody' is responsible for climate protection in the industry (standardised residual: 5.2; very weak but highly significant difference; Cramer's V .165 at n=479; p<.001). Companies that have taken climate protection measures rate the effort as significantly lower (highly significant difference: Mann-Whitney-U-test with z=–4284 at n=503; p<.001). This may be because they are already active and have made some effort and might therefore estimate the effort more accurately. Interviewees in the qualitative survey indicated actual costs were less than expected.

4.2.6 Lack of responsibility

An additional key barrier to climate neutrality transformation was not deduced from the barriers catalogue but from the question of who is responsible for achieving climate neutrality. Many accommodation providers do not see climate protection as their responsibility. Instead, 60 % of them state that politics or guests are responsible (see Figure 5). Only a quarter consider themselves liable. Insufficient sense of responsibility is a major barrier.

There is a striking correlation in accommodation providers' perspectives. Those complaining about excessive or confusing regulations were more likely to call for political control and saw politics as responsible for climate protection (p=.036). This contradictory response stems from feeling overwhelmed by current legal regulations. They demand clear regulations and implementation assistance. This must
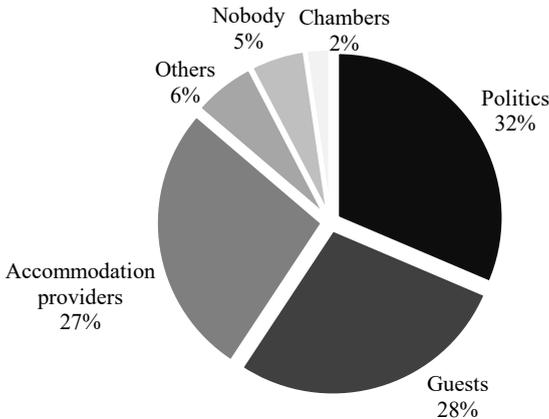
Figure 5: Tourism actors responsible for climate protection from accommodation providers' perspective

be considered when designing support, counselling services and legal regulations. I3 warned of consequences of poorly communicated laws and regulations: '*When we say we're going to issue a regulation or something, it's usually always the case that we say: "Phew, oh dear, okay, now we're being squeezed in somewhere".*' In her opinion, it is necessary to communicate the ecological significance and economic benefits of climate protection and adaptation measures: '*But if we say: "You, listen, that pays off really well!" Or: "That's brilliant!" And speak enthusiastically, then it's simply better for most people than if you say: "There's a regulation, you have to deal with it now".*'

Additionally, travellers pose a challenge as a partially organised group of stakeholders. Their climate-related wishes, needs and expectations require consistent scientific monitoring. However, seeking travellers' consent to the climate neutrality transformation should be avoided. This goal is undisputed given Art. 2 Paragraph 2 of the BayKlimaG. The path to this goal must not deter tourists and provide satisfying accommodation. The acceptance of travellers for the necessary transformation steps is crucial. Guests should be informed that climate-neutral and climate-adapted accommodation can be achieved without significant changes[3] to the tourism product. While the material transformation to climate neutrality involves structural, infrastructural and financial aspects, raising awareness among guests and providers is a communication task.

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3 The point at which 'significant' changes begin is subjective. Achieving climate neutrality requires changes in behaviour, but travellers should not fear completely different – essentially less comfortable – accommodation.

5 Discussion and conclusion

5.1 Discussion of key barriers

This study aimed to explore the barriers to achieving climate neutrality in the Bavarian accommodation sector. The findings reveal that accommodation providers face multiple barriers requiring other stakeholders' involvement. The barriers were summarised in four factors: 'inadequate cost-benefit ratio of decarbonisation', 'denial of responsibility and agency fuelled by uncertainties', 'lack of knowledge' and 'business deemed too large'. The factor analysis shows many interlinked barriers, creating a complex landscape for accommodation providers transitioning to climate neutrality.

The impact of these barriers varies along spatial scales, requiring scale-sensitive strategies. First, the central factors containing the main barriers to climate neutrality in the Bavarian accommodation sector will be interpreted, comparing the findings with key studies (see chapters 2.1 and 2.2). Subsequently, leverage points for overcoming these barriers on different spatial scales are offered.

Inadequate Cost-benefit ratio

Central barriers are the high costs of climate-neutral transformations and concerns over their financial pay-off. Bavarian accommodation providers are deterred from pursuing energy efficiency upgrades or climate-neutral practices due to the perceived financial burden. The expectation of high costs as a barrier to a climate-neutral accommodation sector is consistent with the literature (e. g., Appiah, Adongo, and Safo 2023; Hassanli and Ashwell 2020). These studies highlight the upfront financial burden associated with climate neutrality. Local conditions are often deemed unsuitable, such as heritage conservation preventing insulation and replacing fossil fuel-based heating with heat pumps. Existing subsidy systems and investment incentives sometimes hinder financing climate-friendly conversions. Financing mechanisms often fail to meet the actual need, making the transition to climate-neutral operation seem risky. The upfront investment for transitioning to climate-neutral solutions is substantial, and many Bavarian providers view this as a significant obstacle, particularly for small and medium-sized enterprises dominating the sector. This can deter accommodation providers, particularly smaller businesses, from investing in sustainability initiatives, as described by Adger and Barnett (2009). Without access to financial support or incentives, these businesses struggle to justify the initial costs, despite potential long-term savings and environ-

mental benefits (Goffi, Cucculelli, and Masiero 2019; Gössling and Lund-Durlacher 2021; Hassanli and Ashwell 2020). Based on the empirical results, many businesses have not fully understood this. The short-term orientation of the accommodation sector (e. g., Becken and Loehr 2022; Dickinson, Robbins, and Lumsdon 2010; Hall 2009) might be related to the cost-benefit ratio of the climate neutrality transformation being perceived as inadequate.

This study highlights the complexity and interdependencies of barriers and challenges, extending the current state of research. This complexity is noticeable in the 'inadequate cost-benefit ratio' factor and the 'costs too high' barrier. Although discussed in transformation processes literature (Heyen et al. 2018; Clausen and Fichter 2016), it has mostly been implicitly assumed in tourism studies. The 'finite pool of worry' concept (Marshall 2015) might explain this. It assumes people have limited emotional resources to deal with challenges. If exhausted, no attention remains for 'additional' ones, especially those with no imminent or tangible consequences – such as climate change (Sisco et al. 2023).

Denial of responsibility and agency fuelled by uncertainties

Bavaria's accommodation industry lacks awareness of its climate neutrality responsibilities and a sense of agency, creating a transformation barrier. Only 27.0 % of establishments see themselves as primarily responsible for climate change mitigation. Previous studies on climate mitigation in tourism and accommodation have identified different awareness and commitment levels (Njoroge 2015) as barriers to engagement, but the responsibility question posed in this study is a novelty. There is a lack of clarity surrounding accommodation providers' responsibilities in meeting climate neutrality targets. While EU, German, and Bavarian laws set clear deadlines, many providers are unsure how to comply and who is responsible for implementation. The success of transformations depends on the active, cooperative and consensual commitment of a society's majority to this transformation (Heyen et al. 2018; Jacob et al. 2019). This attitude is lacking in Bavaria's accommodation sector.

This is paired with uncertainty and insecurity about future policy directions and the feasibility of climate-neutral solutions. Businesses and individuals rarely view a climate-neutral future positively in terms of rewards, be they monetary, social or ecological. Instead, many are anxious, fearing economic losses due to uncertainties about the political, economic, social and climatic changes. Many businesses postpone transformative steps due to uncertainty and lack of clarity about technical approaches and financing options, hoping for innovations and climate neutrality in an undefined but near future. Many hosts are confused by the multitude of options for achieving climate neutrality: Should it be done through technical

measures? How much CO_2 should be offset? Do guests have to settle for 'worse' offers for sufficiency? Or will climate change consequences not be so bad, so that action is unnecessary? Due to the open and complex, normatively coloured questions, many hosts feel overwhelmed and react by not acting. The complexity and uncertainty of the operational, political, macroeconomic and climatic future make the effort seem too high and achieving climate neutrality too complicated, especially as the causal link between tourism practices and climate change is sometimes questioned. Accommodation providers expressed concerns about whether today's investments would align with future regulatory frameworks or need retro-fitting. This reflects concerns raised in previous research by Adger and Barnett (2009), UBA (2023) and Grießhammer and Brohmann (2015), who point out that ambiguous and changing regulations create insecurity for businesses. However, this study goes further by illustrating that the uncertainty in Bavaria is not only about policy shifts but also the roles and responsibilities of accommodation providers in meeting the climate-neutrality targets set by regional and national authorities. This uncertainty results in delays or reluctance to adopt climate-neutral technologies.

Furthermore, a barrier emerged regarding insecurity about the market demand for climate-neutral accommodations (see barrier 'travellers' expectations'). Accommodation providers are concerned that investing in sustainability measures may not yield a clear return on investment, particularly if customers are not seeking or willing to pay a premium for sustainable options. Although studies indicate that sustainable tourism will gain importance (Mailer et al. 2019; Zimmer et al. 2022), many accommodation businesses seem to doubt or deny this, given their negligence of climate protection. Indeed, in 2023, sustainability was only for 3 % of German tourists the decisive factor when deciding between otherwise equal tourism offerings, and only 5 % of German tourists chose to compensate greenhouse gas emissions, despite assigning high importance to sustainability (FUR e.V. 2024). The sustainable tourism market in Bavaria is growing but remains a niche and does not represent a significant portion of total demand.

The dependence of pursuing climate neutrality on personal valuation of climate protection highlights the importance of individual awareness of the climate crisis' extent and exigency. Without hosts understanding the consequences of climate change and the urgency of change, the climate neutrality transformation can only happen through legislative force. However, the current social disputes about top-down climate and environmental protection measures show that legislative pressure without mediation leads to counter-pressure and less socio-ecological progress (Mau, Lux, and Westheuser 2023).

Lack of knowledge

Missing knowledge is hindering climate neutrality. Many accommodation providers want climate neutrality but lack the expertise or information to make informed decisions and implement measures. This relates to the companies' greenhouse gas emissions, 74.2 % of which do not know their emissions – and the distance to climate neutrality. The lack of knowledge also concerns climate protection and greenhouse gas emissions reduction: 50.6 % of companies state that this barrier applies to them. Due to the lack of knowledge – also in the form of data – expertise is missing in where emissions could be reduced and with what resources. This results in inaction, exacerbated by the fear of making non-optimal decisions. Hosts complain about the lack of knowledge about changes to building infrastructure and operational processes. Many ideas and suggestions are considered unsuitable. The lack of knowledge also concerns the internalisation of climate change and transformation strategies and their implementation.

This study's findings on the lack of knowledge align with Chin, Day, Sydnor, Prokopy and Cherkauer (2019), who identify knowledge gaps as a critical obstacle for accommodation providers. Previous research highlights the importance of staff training (Appiah, Adongo, and Safo 2023) and environmental awareness campaigns (Gössling and Lund-Durlacher 2021) in overcoming these barriers, which this study has confirmed. Limited information on operational emissions hinders climate neutrality transformation (Tourkolias et al. 2020), also in the Bavarian accommodation sector. The importance of individual knowledge at the company level (Hassanli and Ashwell 2020; Scott 2021) is confirmed, along with the necessity of the will to transform. A successful transformation to climate neutrality requires available knowledge *and* the will to achieve it; neither is effective without the other.

5.2 Leverage points for dismantling transformation barriers across spatial scales

All identified barriers manifest distinctly at the individual accommodation establishments level, originating from varying spatial scales. Accordingly, the starting points for dismantling these barriers are at different scale levels (see Figure 6). The measures to overcome transformation barriers come from the literature in chapters 2.1 and 2.2. However, the categorisation of which barriers are easiest to tackle at which scale is primarily an inductive hypothesis of the authors. It is usually not possible to unambiguously assign barriers and measures to specific scales. The factor analysis and subsequent data interpretation showed numerous interrelationships and interdepend-

encies between individual barriers and scales. This interscalarity also applies to the approaches for overcoming transformation barriers, which are closely interwoven.
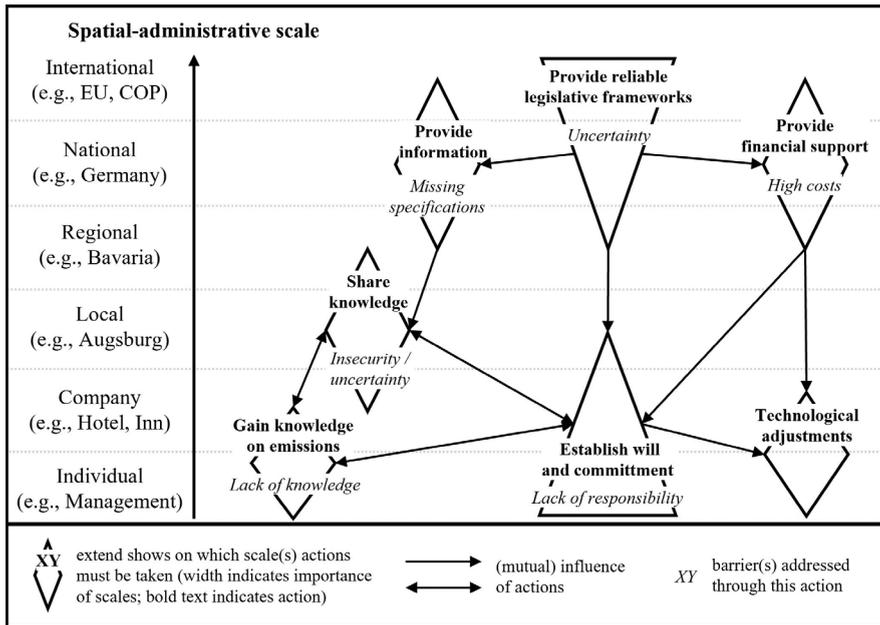

Figure 6: Leverage points for dismantling transformation barriers on different spatial-administrative scales

Understanding the barriers to transformation requires a relational, multi-scalar understanding of the tourism system. The accommodation industry cannot be understood in isolation. Its interactions, feedback with other systems and dependencies must be considered. These interdependencies also appear in Mundt (2011), although his view that sustainable tourism is only possible in a socio-economic system that is itself sustainable at a national, regional and local level is not fully shared. Yet, without downplaying tourism's climate responsibility, the actors are embedded in logics, dependencies and constraints negotiated outside the sector. Their actions are embedded in structures, some beyond control, characterised by diverging interests and power relations. Besides the goal of a climate-neutral accommodation sector, there are competing visions and goals. The persistence of a short-term growth paradigm is striking, where a desirable industry development is not necessarily reflected in climate neutrality, but in rising overnight stays and increasing operational profitability, as Zacher (2022, p. 389) demonstrates for Bavarian destinations, too. Thus, industry structures and logic geared towards these goals

and the corresponding tourism policy interests, as well as the lack of political will to overcome or reform them, create institutional barriers. Hence, the overall political, economic and social structure hinders climate neutrality transformation.

The leverage points for overcoming transformation barriers relate to different spatial-administrative scales (see Figure 6). At the local level, smaller accommodation providers may experience the barriers more acutely. Limited financial resources and local market conditions exacerbate the challenges in implementing climate-neutral practices. In contrast, at the regional level, where larger organisations and collaborations are possible, the barriers are more systemic and linked to regional policy frameworks, regulatory coherence, and broader industry coordination. Finally, at the national and international level, uncertainties regarding regulatory standards and cooperation in the accommodation sector complicate efforts to implement uniform climate-neutral practices. The fragmented nature of global climate policies leaves accommodation providers unsure of how their actions fit within larger, global initiatives aimed at achieving climate change mitigation.

National and international legislation significantly influence the accommodation sector. Establishing a reliable legal framework for decision-makers is essential to curb uncertainty. This legislation should create a framework for sufficient financial support, like interest-free loans for energy-efficient renovations. These funds, primarily from national, and sometimes European or state budgets, would help overcome the 'high cost' barrier and incentivise companies to accelerate the transformation to climate neutrality and technological adjustments (as proposed by Karvounidi, Alexandropoulou, and Fousteris 2024; Tims, Bajzelj, and Painuly 2021; Wu et al. 2022).

Reliable international, national and regional climate neutrality legislation must be communicated as comprehensible information and 'translated' into specific targets to overcome the 'missing specifications' barrier. This translation should occur primarily at the national level and secondarily at regional and international levels. Mere information is insufficient to trigger actions; it must be converted into knowledge at lower scales (regional, local and company level) to reduce uncertainties and share knowledge as well as at the destination level (see also Balas and Mayer 2024). DMOs are important as intermediaries for initiating and moderating knowledge-sharing processes. Besides acquiring knowledge about the legal framework, regulations and funding opportunities, businesses need to analyse their current emissions, overcome the 'lack of knowledge' and determine their greenhouse gas emissions.

These actions aim to generate the will and commitment of decision-makers and opinion leaders at the company and local levels to become climate neutral. Given the current legal circumstances, individual commitment to climate neutrality is

crucial. This study found a correlation between individual appreciation of climate neutrality and the willingness to achieve it.

5.3 Limitations and recommendations for future research

This article's findings can guide measures for a climate-neutral accommodation sector but it has limitations. The study's focus on Bavaria may limit the generalizability of its findings, as Bavaria's political, economic and sociocultural context may not reflect challenges in other regions or countries. This limitation is acknowledged in the literature, where studies by Gössling and Lund-Durlacher (2021) and Walmsley (2011) highlight the need for cross-regional comparisons to understand sustainability barriers across different contexts. Future research should expand the geographical scope beyond Bavaria to include other regions for a comparative analysis of climate neutrality barriers. Another limitation might be the study's cross-sectional nature, capturing a snapshot of the barriers at a specific time. Longitudinal studies, as suggested by Warren and Becken (2017), might track changes over time, as policies and market dynamics evolve. Future research could address this by conducting follow-up studies to explore how the barriers identified in this study change as the accommodation sector adapts to regulatory changes and evolving consumer demand. By accompanying businesses on the path to climate neutrality, strategies for overcoming transformation barriers might be analysed in real time. Ultimately, sample size – especially for non-hotel and non-holiday home accommodations – may not capture the diversity of barriers and their impact across the sector. Differences between large and small accommodations can lead to varying perceptions of barriers.[4] Thus, while the findings provide valuable insights, further research on other types of accommodations might deepen understanding and is crucial for developing targeted interventions.

5.4 Conclusion

This study explored barriers to achieving climate neutrality in the Bavarian accommodation sector, highlighting key obstacles such as 'inadequate cost-benefit ratio

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4 This pertains to the barriers 'company too large', 'company too small', 'energy consumption too high', 'no necessity', 'dependence on other actors', 'obstructive regulations', 'emissions unknown', 'building conditions', and 'travellers' expectations' ($p<.05$). Except for 'company too large' and 'company too small', all correlations are very weak (Somers' D<.2). For both former barriers, Somers' D indicates weak correlations (0.323 and 0.250, resp.).

of decarbonisation', 'denial of responsibility and agency fuelled by uncertainties', 'lack of knowledge' and 'business deemed too large'. These results imply an immediate need for action and suggest starting points. The need for action arises from climate change (Forster et al. 2023), 15 years left to conform with the BayKlimaG, and a rising CO_2 price. Tourism needs to protect the environment as its economic foundation, besides ethical and moral arguments. Based on the data collected, some key results for tourism practice, politics, administration, science and travellers can be derived:

–   The more hosts value climate protection, the easier it is for them to commit to it and financial aspects become less important. Awareness and responsibility are the basis of climate neutrality transformation.
–   For many hosts, climate change is one challenge among many, but not the most acute or important.
–   Implementing climate neutrality often fails due to the perceived organisational and financial effort. Companies must find it easier to become climate-neutral.
–   In many – especially small – accommodation establishments, there is limited knowledge about achieving climate neutrality. This knowledge and support to reduce costs must come from outside.
–   Guests must be prepared to demand and accept changes, managed through communication.
–   To achieve a climate-neutral accommodation sector, stronger cooperation and communication between stakeholder groups is required.

These findings have far-reaching implications for the accommodation sector and tourism in Bavaria and other regions. Addressing climate neutrality barriers requires a multi-tiered approach, with local, regional, and national policies working together to enable the transformation to more sustainable practices. Climate and environmental protection must feature more prominently on the tourism science agenda. The subordinate position of achieving climate neutrality in tourism and tourism science does not reflect its economic, social, or ecological importance. This study reinforces the importance of clear regulatory frameworks, financial support and knowledge-sharing initiatives in transitioning to climate-neutral accommodations. Achieving climate neutrality in the accommodation sector is a political imperative and a practical challenge requiring collaborative efforts across governance levels. Future research and policy must acknowledge the complexity and variability of barriers across spatial scales to create effective, context-specific solutions.

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