Untangling adaptive capacity in tourism: a narrative and systematic review

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Abstract

This study examines peer-reviewed literature on adaptive capacity (AC) in tourism under the condition of climate change adaptation for the publication period of 1990–2019. We analyze and visualize existing research using a combined approach of narrative and systematic reviews and employing software such as NVIVO 12, Python 3.8, and Gephi 0.9.2. We first investigate policy transitions toward sustainable adaptation in tourism and then analyze the systematization of tourism reflected in the definitions of AC. Next, we conduct an in-depth analysis of evolutions in tourism adaptation by interpreting the occurrences and interactions of three main streams of AC: resource, social-psychological, socio-ecological. We conclude that diverse methodologies in tourism research on adaptation contribute to augmenting the quantitative measurement of social factors influencing AC. The findings provide insights into how to improve the adaptation process and advance germane theoretical debates, particularly on the role of human factors in human–nature relationships aimed at developing sustainability.

1. Introduction

Adaptive capacity (AC) is an essential concept at the core of climate change adaptation (Jones et al 2010, Williams et al 2015), particularly when pursuing long-term and sustainable transformation. AC is broadly defined as the ability of a human or natural system to adjust to climate change and moderate potential damage, cope with consequences, and take advantage of opportunities (Intergovernmental Panel on Climate Change (IPCC) 2001, Smit and Wandel 2006). Explorations of AC can shed light on plausible ways to improve local endeavors (Fu 2020). Many studies stated that successful adaptation is mainly determined by the AC of individuals and communities as a whole (Adger et al 2005, Smit and Wandel 2006). More specifically, AC influences individual and collective decisions to proactively adapt to climate change (Grothmann and Patt 2005) and to overcome various socio-political constraints (Biesbroek et al 2013). However, several recent literatures which focus on psycho-social and institutional dimensions challenge the notion that successful adaptation is determined by AC (e.g. Morteux and Barnett 2017, Gawith et al 2020). The evolution and increasing complexity of AC have been significantly influenced by the growing importance assigned to interdisciplinary approaches in the sciences, especially sustainability science. Consequently, AC has developed a kaleidoscopic nature and is used to reflect complex realities. However, this complexity has also made it difficult for researchers to gain deeper insight into the concept.

Tourism is considered one of the least prepared economic sectors for the risks and opportunities of climate change (Scott 2011). AC in tourism is relatively under-researched, and its definition remains ambiguous and unclear (Eisenack and Stecker 2012, Fang et al 2017). This ambiguity is evident from the terminology used interchangeably with AC, such as adaptability (IPCC 2001, Zurlici et al 2012), the system’s coping capacity (Turner et al 2003, Burkette 2020).
response capacity (Gallopin 2003, Faulkner et al. 2020), and resilience (Carpenter et al. 2001, Kaspersion et al. 2005, Gallopin 2006, Smit and Wandel 2006, Parsons et al. 2021). This study argues that such ambiguity has made it increasingly challenging for researchers to identify and measure meaningful indicators of AC, thus hindering the development of sustainable adaptation strategies. To reduce the ambiguity surrounding AC in tourism, we review nearly three decades of theoretical and empirical studies on tourism and climate change and classify them into knowledge domains and distinctive approaches. We use the term ‘adaptive capacity’ for the literature search to ensure the inclusion of valuable studies. Results for interchangeable terms such as ‘adaptation,’ ‘response capacity,’ ‘resilience,’ and ‘coping’ were also considered in the systematic review.

AC research from a tourism perspective can theoretically, methodologically, and empirically contribute to the broader literature on AC and adaptation knowledge. A focused application of AC concepts helps highlight unique geographical aspects and local environments (Mitchell and Murphy 1991). However, most tourism research (e.g. IPCC 1991) applies these concepts to general frameworks. The multidisciplinary nature of tourism studies and the complexity of tourism systems combined with diverse stakeholder engagement and AC interactions across scales and levels (Becken and Job 2014) can offer a systematic view. Furthermore, AC-based tourism research can reinforce the bridge between tourism development, including local and regional connections, and sustainable development.

2. Methodology

2.1. Narrative and systematic reviews

A narrative review entails a description of studies to establish an overall background or context for a specific problem or issue (Demiris et al. 2019). A reviewer may search the databases of reputable websites using keywords to shortlist abstracts, articles, and documents. A systematic review is a structured, comprehensive literature review guided by specific research questions (Demiris et al. 2019) and performed using systematic and explicitly accountable methods (Gough et al. 2012).

The research process followed five steps: (a) select search terms and databases, (b) extract data and evaluate review findings, (c) create research questions for systematic review based on narrative review findings, (d) conduct content analysis to quantitatively and qualitatively analyze and synthesize selected documents, and (e) present the findings. Given our areas of interest, we first performed a narrative review of climate change and tourism research to gain an overview. Next, we framed the research question, How is AC understood in research on tourism and climate change adaptation?, as the basis for our systematic review (figure 1).

2.1.1. Select search terms and databases

We conducted an initial search of publications that mentioned ‘tourism’ and ‘climate change’ to identify the key search terms. Table 1 lists the keywords strongly related to both concepts. For the narrative review, in addition to ‘tourism’ and ‘climate change,’ we searched for synonyms in three major databases: Scopus, Web of Science (WoS), and Commonwealth Agricultural Bureaux (CAB) Abstracts (table 2). We included certain terms directly and indirectly related to climate change or tourism to ensure the inclusion of important studies, and we retrieved more than 4561 articles and documents.

Considering the complex and expansive nature of climate change, we used the following inclusion and exclusion criteria to screen titles, abstracts, and keywords:

- **Inclusion criteria:** relationship between climate change (causes, evidence, impact, mitigation, adaptation, and policy) and tourism development (response, flow, behaviors, challenges, opportunities, and management)
- **Exclusion criteria:** irrelevant or vague topics (e.g. Millennium Development Goals or environmental sustainability)

2.1.2. Extract data and evaluate review findings

We reviewed research published between 1990 and 2019 because the first IPCC assessment report on climate change was published in 1990, and online databases for tourism and climate change were unavailable prior to 1990 (Fang et al. 2017).

To reduce subjectivity in the article selection, we used frameworks and definitions for AC, climate change adaptation, and tourism and referred to related review articles (e.g. Jopp et al. 2010, Kajan and Saarinen 2013, Njoroge 2015a). Following a narrative review of the titles, abstracts, and keywords, we mapped the development of tourism and climate change research. For the systematic review, we used terms for AC, tourism, and climate change adaptation and their synonyms to select papers while identifying trends and gaps in the literature.

2.2. Conduct content analysis

Content analysis, also known as text analysis, is a combination of qualitative and quantitative approaches and a methodological measurement of text (Shapiro and Markoff 1997). Content analyses emphasize language in human cognition and use word frequency as an indicator. We also searched for co-occurrences of keywords to reflect associations between underlying concepts and their latent content (Huff 1990, Carley 1997).
In addition to qualitative methods, we employed quantitative approaches for the literature review. We conducted a content analysis using software such as NVIVO 12, Python 3.8, and Gephi 0.9.2 (figure 2). Quantitative techniques, such as word frequency, helped us to identify key topics discussed in the literature on tourism and climate change adaptation. We also searched for co-occurrences of keywords to identify categories, including the five knowledge domains of AC, to explore relationships and statistically analyze the coded form of text. We first filtered the main content of the articles by deleting items such as titles, abstracts, keywords, and references. Next, we studied how the academic community...
discusses AC using a word–word co-occurrence matrix from natural language processing (NLP) to calculate words appearing before and after ‘AC’. We visualized the matrix as a network diagram generated using Gephi 0.9.2. In particular, we used Python programming and Gephi as tools.

NLP uses computer science to read articles and then performs various statistical estimations. Standard NLP for processing data includes tokenization (using vocabulary as the smallest unit of analysis), stemming, lemmatization, and removal of stop words (Diego 2019). Tokenization involves breaking down complex sentences into words. To retain the original meaning of the words, we skipped the steps of stemming and lemmatization. We removed stop words using the natural language tool kit (NLTK) package. Omitting stop words, which have a grammatical function but no inherent meaning, helped us to focus on words that define the text. This process produced 1595 038 tokens and 15 246 words.

The word–word co-occurrence matrix represents relationships between words in the content (Niwa and Nitta 2003); it highlights the number of words connecting before and after a given word, the number of occurrences, and the strength of the connection (Bullinaria 2008). The method reveals the directionality of the word links and the expected context of the keywords. The matrix then draws the connected words into a network graph using a built-in network drawing function in Gephi3. To create a word–word co-occurrence matrix, we first divided the words into a group to represent their relationship. We categorized three tokens in a group using NLTK’s n-gram function and set n to 3. We then created a matrix in which the row and column numbers corresponded to the number of vocabulary words from the articles. The row contained input words (recent words), and the column included output words (words before and after the input word). Finally, we calculated the number of times the input and output words appeared together and recorded it into the matrix. To visualize the co-presence matrix and word frequency as a network image, we adopted the concept of network analysis (Chiesi 2015) in which a node is a single independent word. The results of the co-occurrence matrix represent the relationship between nodes. Node size varies according to the weight of the data entered, and the strength of the association differs between networks. The software has several built-in algorithms to optimize the distance and presentation of the network graph so that users can easily draw clear network graphs.

3 Gephi is an open-source software for network analysis that transforms data into a network diagram based on an input table or matrix (Bastian et al 2009).
Finally, we used NVIVO 12 to run a text search query for ‘AC’ to explore how other scholars discussed the concept and found five knowledge domains. We performed the text network analysis on not only the total data content but also each knowledge AC domain. We examined each branch of the AC word tree to analyze and synthesize text networks for each knowledge domain.

3. Results

3.1. Main characteristics of tourism and climate change research

3.1.1. Large gap in the geographic distribution of literature and dominance of adaptation studies

We observed interactions between the number of tourism and climate change studies and the IPCC assessment cycles. In the early 1990s and 2000s, climate change and tourism studies were sparse and focused mainly on the climate’s impact on tourism (Smith 1990, 1993). This likely explains why the first IPCC assessment report published in 1990 did not mention tourism (Wall 1998). In the fourth assessment report in 2007, however, the IPCC created more space for tourism, although certain key issues, such as the contribution of tourism to climate change, were ignored (Amelung et al. 2008). Thereafter, we observed an increase in the number of studies, with a peak of 22 publications in 2010 (figure 3(a)). In the same year, we witnessed the introduction of the term ‘sustainable adaptation’ in tourism (Njoroge 2015a) and dynamic debates among scholars (Scott 2011, Weaver 2011, Gossling et al. 2012) in response to the question, ‘Can sustainable tourism survive climate change?’ Consequently, tourism featured more prominently in the fifth IPCC assessment report, particularly with respect to the sector’s transboundary impacts and contribution to climate change, as well as mitigation requirements (Scott et al. 2015). However, since 2016, there has been a decline in studies on tourism and climate change.

In terms of the geographical distribution of the research, the majority of studies focus on developed countries (figure 3(b)), with most studies being reported for Australia (21), New Zealand (10), and the United Kingdom (10). This geographical distribution is likely explained by the high proportion of publications in skiing destinations (mainly Europe) and coral reefs (Australia), which are severely threatened and must adapt to the impact of climate change (Scott 2011).

Referring to Becken (2013) and IPCC (2001), we divided the tourism and climate change literature into six thematic scopes (figure 3(c)). We found that adaptation reported the highest number of studies (73), followed by impact and vulnerability assessments (51).

3.1.2. Latent communications among scholars and lack of AC knowledge

Figure 4 shows the publication trend by year from 1990 to 2019. The majority of the published research adopted qualitative methodologies (48.9%), followed by quantitative (32.8%) and mixed (18.3%) approaches (figure 4(a)). Since 2015, however, the number of quantitative studies has surpassed those of qualitative ones, although to a relatively insignificant degree. Further, the number of studies from developing countries steadily increased but continued to lag behind those from developed countries.

Figure 4(b) illustrates the thematic scope of research. It shows the dominance of adaptation studies in 2013, followed by a sharp increase after 2018. Notably, there is evidence of latent communication among scholars via thematic scopes in tourism and climate change research. More specifically, the surge periods for adaptation studies (2011–2013 and 2018–present) are often reported after an increase in impact or vulnerability assessment research (2009–2010 and 2016–2017). We posit that this surge occurs because of the interaction among cause, effect, and solutions in tourism and climate change studies. Policy-based analyses, by contrast, focus on mitigation, especially in the energy and transportation sectors (Mayor and Tol 2007, Pentelow and Scott 2010, 2011, Peeters and Eijgelaar 2014), and tend to fluctuate in tandem with mitigation studies.

Figure 4(c) maps publication trends from a regional perspective. The number of tourism studies focusing on adaptation significantly exceeded that of mitigation analysis in both developed and developing countries. Adaptation research reported the highest publication rate in both developing (35.29%) and developed (39.56%) countries. We attribute this prevalence to local actions and their significance in adaptation research. Adaptation takes priority in the face of climate change, irrespective of the impacted policy and social factors, tourism industries, or corporations. Moreover, empirical researchers from both developing and developed countries can easily develop adaptation research by employing the IPCC Technical Guidelines for Assessing Climate Change. Policy-based tourism research accounted for 11.76% of the studied literature in developing countries but only 5.49% of that in developed countries. This difference is likely due to the greater prevalence of top-down approaches and government-led actions in developing countries facing environmental issues and climate change (Lebel et al 2009). Consequently, developing countries often adopt policies and climate change adaptation frameworks proposed by developed countries or general organizations, such as the IPCC. Such policy transfers or supported policymaking have prompted policy analyses by researchers in developing countries (Belle et al 2005, Van Der Bank and Van Der Bank 2018). However,
most policy-based research in developed countries focuses on transportation policies (Mayor and Tol 2007, 2010, Dubois 2011), owing to the burgeoning tourism sector and its harmful effects on the environment (Khan et al 2020). The proportion of research studying the impacts of climate change on tourism, including physical and socioeconomic impacts, is greater in developed countries (27.47%) than in developing countries (23.53%). This body of research in developed countries constitutes a firm foundation for future exploration of mitigation and adaptation. In brief, developed countries continue to play a dominant role in terms of research frameworks, synthesis studies on climate change, and international agendas focused on tourism (e.g. Scott 2006, Mayor and Tol 2010, Scott et al 2010).

While there is growing interest in climate change adaptation and tourism, adaptation research tends to focus on framework analyses (22 articles) (e.g. Scott 2006, Kaján and Saarinen 2013, Njoroge 2015a, 2015b) and lacks theoretical and empirical discussions of AC. This lack of theoretical debate can be attributed to the lack of a comprehensive understanding of AC in tourism studies. Thus, the next subsection analyzes the overall approach of tourism and climate change research to AC.

3.2. AC and its knowledge domains

We apply the results of the text query search for ‘AC’ to a scale model in a semantic words analysis. The analysis presents 12 sub-domains that are broadly divided into five knowledge domains for further analysis: AC definition, components, measurement/assessment, stakeholders, and constraints (figure 5). The findings provide a systematic and comprehensive view of the topic and highlight current and future climate change responses and sustainability trends in tourism research.

3.2.1. Systematization of tourism in the definition of AC

The majority of tourism research on climate change cites the IPCC’s (2001, 2007) definition of AC (Simpson et al 2008, Njoroge 2014, Parson et al 2017, Hoogendoorn and Fitchett 2018, Rahmawati et al 2019, Huynh and Piracha 2019), which explains the frequent mentions of ‘IPCC’ and the years ‘2001’ and ‘2007,’ when the IPCC published two assessment reports (figure 6). Other AC definitions observed in tourism-based adaptation studies are taken from the UK Climate Impacts Programme (UKCIP 2009, Csete and Szécsi 2015) or Smit and Wandel (2006),...
According to the word frequency and network analysis in figure 6, ‘adaptation’ is the most commonly cited word with the densest connection, thus reinforcing the role of AC in strengthening climate change adaptation.

Few tourism studies have attempted to define AC. Simpson et al (2008, p 16), the most frequently cited study, defines AC as ‘the ability or potential of a tourism system to respond successfully to climate variability and change is termed AC; this includes adjustment to both behavior, and resource and technology use.’
3.2.2. Evolution of adaptation in AC components with three main streams
An analysis of AC definitions reveals frequently appearing components such as ‘information,’ ‘social,’ ‘economic,’ ‘resources,’ and ‘system,’ indicating the main streams of AC component analyses. Tourism researchers have viewed AC components from a geographical lens using diverse variables and contexts and have thus examined different groups of AC components (figure 7 and appendix 1 available online at stacks.iop.org/ERL/16/123001/mmedia).

3.2.2.1. First stream of AC: resource-based approach
In a resource-based approach, adaptation depends on the ‘access’ and ‘resources’ of individuals, communities, industries, and governments, which explains the frequent mention of ‘access’ and ‘resources’ as AC
components and their link to terms such as ‘financial,’ ‘natural,’ and ‘local’ in the network (figure 7). The approach draws on IPCC’s definitions and guidance of AC with quantitative variables and thus occupies the largest proportion of literature. While AC components in tourism research using a resource-based approach are adopted from a sustainable livelihood framework (Goodwin 2003), we argue that they represent the characteristics of the tourism industry, particularly systematization, proactivity, and economic efficiency.

Systematization is manifested in a combination of capital types, typically financial, physical, and social capital. In the tourism literature, financial capital is represented by money, financial support, financial implications for infrastructure, technical resources for telecommunication development, public transportation systems, regional tourism marketing, and the level of dependence on tourism for income and employment. Physical capital takes the form of infrastructure and services, such as technical support; improvements in technology, such as disaster prevention techniques; healthcare services; and access to technology, resources, equipment, information, and insurance (appendix 1). Scholars have adopted a temporal approach to physical capital, further dividing it into long-and short-term physical capital. Long-term physical capital requires considerable financial investment in hard infrastructure, such as building dikes for flood prevention, while short-term physical capital warrants lower equipment investment and depends on technological development that benefits tourism, such as artificial snowmaking machines (Saarinen and Tervo 2006, Beeken and Hay 2007, Scott and McBoyle 2007) or air conditioning (Hennessy et al 2008, Saarinen et al 2012, Hambira et al 2013). Notably, most surveyed participants asked for financial support to improve infrastructure (physical capital) (Hoffmann et al 2009, Saarinen et al 2012, Hopkins and Maclean 2014). However, there is generally a lag in response by governments and destination management organizations (DMOs) to climate change impacts. Consequently, tourism operators tend to cooperate with each other to improve infrastructure, electricity, and water supply. Collaborations are crucial for coping with the uncertain and long-term impact of climate change, given the short-term and profit-oriented nature of tourism investments (Saarinen and Tervo 2006, Scott and McBoyle 2007, Turton et al 2010, Ruhasen and Shakeela 2013). As such, collaboration is a key element of social capital, specifically cross-collaborations (bridging linking) (Hoffmann et al 2009, Horng et al 2012, Paunović and Jovanović 2017) between local and regional tourism (Jopp et al 2013), between tourists and operators (Horng et al 2012), or between similar stakeholders (bonding linking). An example of such a collaboration is the exchange of machines between ski lift operators (Hoffmann et al 2009). Such collaboration shows the proactivity and economic efficiency of the tourism industry in mobilizing and combining AC. However, given the nature of financial collaboration in tourism, we argue that long-term adaptation strategies are lacking. The tourism sector’s response to climate change is not directly related to environmental and socio-cultural sustainability but rather to the mitigation of climate change impacts for tangible short- and medium-term benefits.

To the effect of human capital, tourism AC research commonly features the terms ‘knowledge’ and ‘information.’ Knowledge is a key factor motivating actions for climate change adaptation (Browne and Hunt 2007, Njoroge 2014), including knowledge accessibility (Browne and Hunt 2007, Jopp et al 2013,

![Figure 7. Text network of AC components.](image-url)
Kajan and Saarinen 2013, Csete and Szécsi 2015), sharing (Jopp et al 2013), and sources, particularly for local and traditional knowledge (Simpson et al 2008, Hopkins and Maclean 2014, Kajan 2014). In concurrence with tourism stakeholders, especially tourism operators, we believe that information is a key feature of economic services such as tourism, which is dynamic and must keep pace with market fluctuations and trends. It is advantageous for the tourism industry to cope with climate change risks and seize related opportunities. Authentic local knowledge is a contribution of human capital. We believe that the agility of the tourism industry can transform authentic human and social capital into potential tourism products in line with climate change adaptation.

Compared with other capital types, political capital and its variables are less frequently mentioned, given their intangible nature. However, political capital is key to activating other types of capital (e.g. financial, physical, and social), particularly for long-term adaptation. The two most frequently mentioned words for political capital are ‘policy’ and ‘government.’ In the context of tourism, political capital encompasses policy transparency, empowerment, governmental guidance, institutions, power structures and relations, and emergency planning.

3.2.2.2. Second stream of AC: psychosocial factors

The above-mentioned resource-based approach helps quantify AC in a vulnerability assessment. However, it does not elucidate adaptation in diverse settings, particularly those subject to social vulnerability (Adger 2006) and social capital (Pelling and High 2005). Empirical studies have shown that a higher AC does not necessarily indicate more adaptation actions (Matasci 2013, Csete and Szécsi 2015). This finding highlights the critical issue of the social inclusion of vulnerable communities, individuals, tourism entrepreneurs, and tourists in AC and climate change actions, a knowledge gap that future AC studies can address.

Tourist behaviors and psychology are the most popular topics in tourism research (Crouch and Perdue 2015). Psychosocial factors and their role in manipulating actors through adaptation behaviors and actions are a sub-stream with significant potential in the context of AC-based tourism research. Psychosocial factors include public perceptions and awareness of risks associated with climate and environmental changes, attitudes, risk aversion, and influences of past experiences on perceptions (Hall 2006, Scott and McBoyle 2007, Horng et al 2012, Pröbstl-haider and Haider 2013, Jopp et al 2013, Becken and Wilson 2016). ‘Awareness’ is one of the most commonly used words among the psychological-social factors (figure 7) driving adaptation actions. However, our literature review highlights two trends in the role of climate change perceptions and awareness in spurring climate change action. First, while some studies confirm positive correlations between heightened climate consciousness and climate change actions (e.g. Hoffmann et al 2009, Schweriplies and Ziegler 2016), several others conclude that high awareness does not always culminate into action (e.g. Matasci et al 2013, Han et al 2016). Studies on awareness and adaptation actions reveal a strong correlation between ‘awareness’ and ‘information’ (Hall 2006, Parsons et al 2017, Schliephack and Dickinson 2017). Therefore, we argue that resources related to ‘information’ are precursors to psychosocial factors, such as perception and awareness. In other words, the transition from thought to action necessitates the intervention of other resources, such as information, knowledge, and education. The second trend pertains to the complexity of climate change responses by the tourism industry. The added strength of interdisciplinary science will create more prospects for tourism research on behavioral transformations in response to climate change.

3.2.2.3. Third stream: system approach and AC–resilience relationship

Given the complexity of adaptive systems in tourism, the system approach has gained increasing scholarly attention. The terms ‘system’ and ‘resilience’ report high frequency in the text network for both AC definitions and components (figures 6 and 7). In a tourism destination (Becken 2013) perceived as a social-ecological system, AC is the capacity of social-ecological systems, including both their human and ecological components (Chapin et al 2009) to respond to, create, and shape variability and change in the state of the system (Walker et al 2004, Adger et al 2005).

Most tourism and adaptation studies adopting this approach concur with the intersection of AC and resilience in managing and retaining a system’s stability. An AC perspective assigns greater importance to human actors’ proactivity and human–nature relationships in the conventional management paradigm of ‘nature for people’ (Mace 2014), wherein human actors transform an undesirable stable state into a desirable one. This perspective explains the increasing popularity of short-term, tangible solutions employed by the tourism industry in response to climate change. A resilience approach, on the other hand, considers humans part of natural systems. Forests and lakes, for example, have all the principles of a natural system and the ability to resist or adapt to change without human intervention. The resilience perspective seemingly reflects a shift in the current management paradigm. We argue that the management paradigm is context-dependent, and
there is no ideal paradigm from either an AC or resilience viewpoint. Thus, the evolution of adaptation strategies is reflected in a dynamic context wherein diversity and flexibility are indicators of high AC or resilience (Luthe et al. 2012, Jopp et al. 2013, Wyss et al. 2014).

3.2.3. AC measurement and practitioners

3.2.3.1. Enhancing AC assessments through diverse research methods from a psychosocial perspective

While there is no direct measurement approach for AC, it can be estimated based on social, economic, and institutional factors (Simpson et al. 2008). The prevalence of qualitative methodologies for perception and behaviors, such as policy analysis, framework analysis, and in-depth interviews, can be explained by thematic scopes adopted in the research frameworks (nine articles) and tourism business responses (six articles) (figure 8 and appendix 2). Researchers have adopted diverse quantitative methods to measure AC components. These include contingent visitation for visitor behaviors and their willingness to pay for climate change policies (Richardson and Loomis 2004); econometric analyses to examine for positive influences of climate change awareness on corporate adaptation (Hoffmann et al. 2009); network analyses to assess agency and cooperation in tourism networks aimed at building resilience (Wyss et al. 2014); regression analyses to assess environmentally responsible behaviors (Tsai et al. 2016); and micro-econometric analyses to determine awareness of climate change effects and social feasibility for adaptation (Schliephack and Dickinson 2017). The text analysis for AC measurement (figure 9) highlights the following AC components as commonly mentioned psychosocial factors: ‘information,’ ‘social,’ ‘perceptions,’ ‘knowledge,’ ‘education,’ ‘values,’ ‘awareness,’ and ‘network.’ These factors are primarily measured using quantitative methodologies (appendix 2) that partially enhance AC assessments, particularly in the case of unquantifiable social factors (Adger 2003).

3.2.3.2. Strong collaboration among tourism stakeholders for adaptation and diversity of stakeholders’ AC impacting adaptation strategies

The tourism industry involves extensive participation by stakeholders, and there is strong cooperation among tourism stakeholders aimed at adaptation. The text network analysis revealed ‘community,’ ‘business,’ ‘tourist,’ ‘destination,’ and ‘operators’ as the most frequently mentioned terms (figure 10), thus indicating three main sub-sectors of tourism stakeholders with strong connections (Scott and Jones 2006): tourists, tour operators (business), and communities. These stakeholders include locals, tourists, industries, businesses, governments, authorities, and communities (figure 10).

The tourism sector is known to be more vulnerable than the overall economy (Dogru et al. 2019). Nevertheless, a large body of work confirms the high AC of the tourism industry, which is contingent on its stakeholders (Scott 2006, Scott and Jones 2006, Becken and Hay 2007, Simpson et al.
The mobility of stakeholders strongly impacts the industry's AC (Scott and Jones 2006, UNWTO-UNEP-WMO 2008). In other words, actors with high mobility (e.g. tourists) have higher AC, while those with low mobility (destination) have lower AC (figure 11).

The implementation of adaptation strategies differs according to the stakeholders and their level of AC. In the context of tourists, the AC components mainly cited in the literature include knowledge, education, health, experience, beliefs, risk aversion, financial resource information, and media (figure 11). These components influence tourist perception, decision making, and traveling behaviors. Thus, the major adaptation strategy for tourists is behavioral adaptation (Jopp et al 2013, Njoroge 2014), which includes changes in participation timing, activity substitution, and choice of destinations (Schwirplies and Ziegler 2016). In addition, tourists consider technical adaptations, such as changes in equipment and techniques (Browne and Hunt 2007).

Destination actors reported the highest number of AC components cited and measured in the literature (figure 11). Stakeholder AC for a given destination differ based on their resources, indicating the need for more diverse adaptation strategies. Tourism operators, regional governments, and tourism industry associations adopt various management adaptation approaches, ranging from marketing techniques, such as new pricing strategies and product/market diversification to repositioning strategies aimed at influencing travel during certain periods (Jopp et al 2011). Technical adaptation is popular among tourism operators (Scott et al 2006, Hoffmann et al 2009, Scott et al 2009), although it varies depending on their financial resources. Tourism operators can employ inexpensive, short-term technical solutions such as air-conditioners or shade nets during hot summers (Saarinen et al 2012, Hambira et al 2013, Huynh and Piracha 2019), which may be considered maladaptive in the long-term (Hopkins 2013). However, long-term technological adaptations, such as the construction of sea walls, desalination plants, and prevention against natural disasters and rising sea levels, warrant government support and financial aid (Hall 2006, Huynh and Piracha 2019). The choice between applying long- and short-term technical adaptations is contingent on...
AC factors, including financial aid from governments, knowledge, information (Becken 2005, Scott et al 2015), and tourism investment policies. Several studies have shown that tourism entrepreneurs hesitate to invest in long-term sustainable adaptation technologies, given the short-term nature of investments (Hennessy et al 2008, Saarinen et al 2012, Njoroge 2015b).
3.2.4. Barriers and solutions

The most commonly cited barriers to adaptation across 64 reviewed documents are ‘government,’ ‘planning,’ ‘economic,’ ‘information,’ ‘infrastructure,’ ‘perception,’ ‘technological,’ ‘knowledge,’ ‘financial,’ ‘collaboration,’ and ‘strategy’ (figure 12).

Matasci et al. (2013) highlighted five key barriers to the adaptation process: social feasibility, social acceptability, institutional, technological, and economic feasibility. We propose a list of AC components that can be mobilized for each adaptation phase to overcome each barrier (figure 13). The first phase focuses on the role of social AC factors, with perception and recognition playing a major role in climate change actions requiring immaterial capital (Pelling and High 2005). Here, social capital includes networks, beliefs, trust, communication, and stakeholder collaboration, and human capital comprises information, education, and knowledge to achieve mutual understanding and reciprocity. In cases where governments lack strategic planning for climate adaptation, local knowledge and experience become critical adaptation tools. However, such adaptations are spontaneous and short-term, creating detrimental impacts in the long term (Saarinen et al. 2012, Hambira et al. 2013, Huynh and Piracha 2019).

Thus, the second and third phases, in which thought is transformed into action, require political capital, such as governments, incentives, policies, planned adaptation management, and financial and technological support. From a socioecological perspective, our findings confirm the role of human actors’ proactivity (perception and recognition of change) in mobilizing resources and their ability to adjust and improve system resilience. In the absence of fundamental changes to perception and recognition, the response of tourism actors to climate change remains ‘reactive.’
4. Discussion and conclusions

In this study, we conducted a narrative review of 186 published works to provide an overview of tourism and climate change research. The review highlights a significant gap in the geographical distribution of both research fields between developing and developed countries; the latter reports a greater proportion with a focus on impacts, frameworks, and policy analyses. This difference is understandable given the lack of resources in developing nations, such as measuring equipment, quality data, and open databases. Consequently, there is a dearth of research on physical impacts and an empirical basis for framework and policy development. The paucity of research in developing countries has simultaneously hindered policy transitions toward sustainable adaptation in the highly local tourism industry. Therefore, we recommend data sharing by international databases and support from the scientific communities of developed countries toward developing countries to resolve the imbalance in the geographical distribution of the literature. In addition, scholars must engage in theoretical and practical discussions on climate change and sustainable tourism (Becken 2014), as well as in the interweaving of vulnerability and adaptation studies. The fluctuating size of the literature, especially since the first mention of the term sustainable tourism in 2010, is a timely supplement of knowledge for IPCC assessment cycles and demonstrates the dynamism of scientists studying tourism under climate change.

The systematic literature review also revealed five knowledge domains of AC. Our findings contribute to a comprehensive view of AC in tourism and in general. We specifically examined the evolution of socioecological approaches and found that climate change adaptation in tourism has developed from anthropocentric resource-based and sociopsychological approaches. The objective of these approaches is to achieve equilibrium between nature and human elements in tourism systems, which is the primary area of interest in research on protected areas and tourism types, such as ecotourism and nature-based tourism (Becken 2013, Hambira et al 2013). Anthropocentric resource-based and sociopsychological approaches can be used to extend the scale of AC elements to include ecological elements, such as the AC of vegetation, water, and animals. The findings can provide constructive contexts for tourism research and the transdisciplinary characteristics of AC-based tourism studies in the context of climate change. The tourism industry utilizes social and human capital from local indigenous communities and thus has strong potential to help achieve environmental, social, and economic SDGs.

We also found that tourism’s contribution to climate change adaptation is not limited to a systematic approach in a diverse field with several stakeholders and their adaptation strategies. It provides insights into improving AC measurements (e.g. assessing social factors) by drawing on the strengths of quantitative, marketing, and behavioral research. This study suggests that each group of AC components can be mobilized during the various phases of adaptation to improve efficiency and remove barriers to adaptation, with an emphasis on fundamental changes in perception and recognition. In contrast to other economic sectors, the AC of individual stakeholders in the tourism industry is affected by their mobility, which is the ability to move individuals and their assets away from disasters or areas impacted by climate change. Therefore, managers and governments should account for mobility during the development and implementation of local adaptive strategies and focus on the AC of each target group to achieve long-term efficiency. Avoiding adaptation in one group can lead to the maladaptation of others (Scott 2009).

Given the characteristics of tourism enterprises (short-term investments, limited capital, and small business size), AC-based research highlights the importance of collaboration as an inevitable strategy. While this is a novel finding in the context of social capital in tourism, in practice, the adaptation of tourism (Smit and Wandel 2006) is mainly a short-term coping and survival technique and not a sustainable long-term adjustment. Therefore, DMOs and governments must appropriately adjust investment and cooperation mechanisms to better utilize available social capital and improve adaptation efficiency.

Data availability statement

All data that support the findings of this study are included within the article (and any supplementary files).

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Conflicts of interest

The authors declare no conflicts of interest.

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