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Past, present, and future of pro-environmental behavior in tourism and hospitality: A text-mining approach

ABSTRACT

Scholars have been interested in examining what drives pro-environmental behavior. However, only a few scientific studies have been devoted to analyzing and understanding the pro-environmental behavior of those that are on vacation. Therefore, the current paper contributes to the existing literature by employing a text-mining approach to conduct a full-text analysis of 210 articles and (1) describes pro-environmental conceptualization, (2) presents the important topics and studies that have emerged from the literature, and (3) suggests directions for future research. The eight core topics that were uncovered contributed to discussion of the content of publications, related theories, core constructs, methodologies, main authors, and journals. The paper shows that the literature on pro-environmental behavior uses more quantitative than qualitative approaches and uses structural equations or regression analysis to explore the data. The findings also show that researchers tend to employ well-known theories arising from psychology, sociology, and biology.

Keywords: pro-environmental behavior, climate change, hospitality, tourism, text-mining, theory-context-characteristics-methodology framework.

1. Introduction

Tourists as consumers are demanding that enterprises make changes in order to reduce waste, pollute less, and have a more sustainable and pro-environmental approach

to tourism. Pro-environmental behavior has its roots in environmental psychology, which is aimed at understanding and improving human relations with the natural environment and making the built environment more humane (Gifford, Steg, & Reser, 2011). Even though the first studies about pro-environmental behavior date back to the late 1960s (Gifford, 2013, p. 543), it was only in the early 1970s that Craik's (1973) study about environmental psychology led to rapid expansion of the topic into other fields besides psychology (Borden, 1977; Gifford, 2013). Despite recent literature reviews giving an overview of how consumer behavior has changed in terms of sustainability in marketing (White et al., 2019) and what influences an individual's pro-environmental behavior in economic, waste management, and disposal areas (Li et al., 2019), no recent reviews have studied pro-environmental behaviors in the specific context of tourism and hospitality. Tourism is the world's third largest export category, behind chemicals and fuels and ahead of automotive products and food (UNWTO, 2019). As a result, tourism has a significant impact on the global economy. Although the tourism industry has positive impacts on destinations by promoting new business opportunities, preserving historic buildings and cultural sites (Loureiro et al., 2019a), the negative impacts of tourism should also be noted, such as greenhouse gas emissions, environmental damage, and pollution (Lenzen et al., 2018). Even though the global pandemic situation of 2020 and the subsequent lockdown measures introduced by different countries have contributed to reducing air pollution (WEF, 2020), the gradual easing of lockdown has led to increased pollution and the increased use of disposable materials, such as masks and gloves. Thus, managers face the challenge of how to offer comfort, hygiene, and safety at destinations and hotels without compromising the environment. Therefore, an up-to-date literature review exploring the main issues

studied in pro-environmental behavior and discussing what may drive a future research agenda is relevant for both academics and practitioners.

Hence, the current paper contributes to existing knowledge about the impacts of pro-environmental behavior on tourism and hospitality by (1) exploring the past literature after a comprehensive collection of the relevant articles and (2) employing a text mining approach based on a hierarchical Bayesian model to find relevant latent topics (Loureiro et al., 2019b; Guerreiro et al., 2016). Furthermore, it discusses the main trends in pro-environmental behavior following the TCCM framework (Paul & Rosado-Serrano, 2019), grounded on the previous literature. The TCCM framework splits the main future trends into different domains, which include (T) theory and (C) context, and they include the areas of application that are in this case already defined as hospitality and tourism (C) characteristics, which are the main constructs, and (M) methodology.

2. Database Search Process

Papers about pro-environmental behavior were collected from Scopus and Web of Science to identify the most relevant literature for this study. They were collected using terms around pro-environmental behavior related to tourism and hospitality. Although the term *ecological behavior* may also be used to address pro-environmental behaviors, the first query on WoS revealed only 8 papers about hospitality and tourism using that term. As this paper explores the well-established construct of *pro-environmental behavior* and given the lack of representativeness of other competing terms in this sector, pro-environmental behavior terms were used. The query was applied to the title, abstract, and keywords. Table 1 shows the queries used to collect the articles.

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A total of 169 articles were extracted from journals indexed in Web of Science, and 424 articles were extracted from the Scopus database. The difference in the number of articles indexed on WoS and Scopus is because Scopus indexes more publications, journal titles, conferences, and books than WoS, and the articles indexed on WoS are usually indexed on Scopus. After merging both sources to identify single articles, 491 papers were selected for further analysis. Considering the consistency standards proposed by Macpherson and Holt (2007), two researchers separately analyzed the relevant articles and classified them according to how they were related to pro-environmental issues (see Appendix A). A Cohen's Kappa coefficient > 0.85 was found after discussing the analysis among the researchers. Cohen's Kappa (k) (Cohen, 1960) is a widely used and accepted measure of inter-rater reliability and is frequently used as a measure of how much a group of evaluators agree about a decision. An agreement is reached when k > 0.80. When agreement is reached, this is guaranteed to reduce selection bias (Pérez et al., 2020). Although the papers included the word hospitality or tourism, the first analysis of the title and abstracts revealed that 111 papers did not address issues directly connected to the sector. Instead, those words just pointed out some potential future implications. An in-depth analysis of the full texts also removed 170 articles that (1) were not directly related to the research objective, (2) had a weak development of the literature, (3) had incomplete data and were not related to the theory, and (4) made little contribution to theory and/or practice (see Appendix A). A final set of 210 papers focusing on the pro-environmental behavior of hospitality and tourism was selected. The articles were published between 2002 and 2020. Figure 1 shows the screening process used to select the papers.

(INSERT FIGURE 1 ABOUT HERE)

3. Descriptive analysis

The literature about pro-environmental behavior starts in 2002 with the paper by Higham and Carr (2002), which shows that visiting ecotourism destinations affects environmental values. After being exposed to these types of experiences, consumers were more likely to consider environmental issues. The results also show that over the years, there has been a steady increase in the number of papers addressing pro-environmental issues. More than half the papers analyzed (117) were published after 2017 (see Figure 2).

(INSERT FIGURE 2 ABOUT HERE)

The results also revealed the most prominent authors in the field. The author with the greatest number of publications is Heesup Han with 22 articles, followed by Haywantee Ramkissoon with 11 articles and Sara Dolnicar with 8. Table 2 lists the number of articles per author. The papers were also analyzed using Larson et al.'s (2015) behavioral dimensions of pro-environmental behavior, which included conservation lifestyle, social environmentalism, land stewardship, and environmental citizenship. Most papers study conservation lifestyles, which are behaviors related to recycling and efficient use of resources. The next most studied groups include social environmentalism, referring to the behavior of participating in local groups and educating others about environmental issues and land stewardship, the behavior related to enhancing private or public habitats to favor wildlife, and finally environmental

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citizenship, which involves participating in policy creation and political intervention (see Figure 3).

(INSERT TABLE 2 ABOUT HERE)

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The 210 articles were also analyzed in-depth in order to identify the underlying theories, constructs, and methods. A concordance analysis of the word *theory* revealed the main theories addressed in the papers. Concordance analysis (Orange, 2020) finds the context of a specific word in the text. After a thorough analysis of the results, the articles were classified according to the theories used in each study. The results show that the theory of planned behavior (Ajzen, 1985) is the most frequently used theory in the papers about pro-environmental behavior, followed by the theory of reasoned action (Ajzen & Fishbein, 1980), the value belief-norm (Stern et al., 1999), and the norm-activation model (Schwartz, 1977). Attachment theory (Bowlby, 1988) and goal-directed behavior theory (Perugini & Bagozzi, 2001), used to a lesser degree than the other examples, have also been used in the literature. Figure 4 shows the theories mentioned in at least five papers.

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The articles were also analyzed according to the constructs used to formulate the hypotheses or the conceptual frameworks. The results show that most of the articles used norms constructs (102). These include subjective, social, personal, and moral norms. Other important constructs used in the conceptual models include behavioral

intention constructs (49 papers), attitudes (42 papers), and constructs related to measuring pro-environmental behavior directly, including both the behavior (PEB) and the behavioral intention (PEBi) (52 papers). The constructs identified are included in some of the most frequently used theories for pro-environmental behavior, including the theory of planned behavior (Ajzen, 1985), the norm activation model (Schwartz, 1977), the value belief norm (Stern et al., 1999), and the theory of reasoned action (Ajzen & Fishbein, 1980). Figure 5 shows the main constructs appearing in at least 10 papers.

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A final analysis was conducted to classify the methods used in each paper. Most of the papers used surveys (164 papers), and of those, most used structural models (93 papers). Structural models include co-variate based structural equation modeling (CB-SEM), used in 80% of the papers, and partial-least squares structural equation modeling (PLS-SEM), used in 20% of the papers.

Mixed methods were identified in 12 papers, and some qualitative papers were identified (14 papers), but most of them (135 papers) used quantitative methods. Figure 6 shows the methods identified in at least 10 papers.

(INSERT FIGURE 6 ABOUT HERE)

4. Topic analysis method

A Bayesian inference topic model based on a latent Dirichelet Allocation algorithm (LDA) (Blei et al., 2003) was used to associate every paper with a probability distribution over the latent topic. The LDA is a generative probabilistic model where a

set of latent topics are produced as a result of a multi-membership clustering technique that uses Dirichelet distribution to assign the posterior probabilities. The method first creates the latent topics that have correlated terms, and then produces the posterior probability of each paper belonging to each topic. However, because the papers do not exclusively discuss a single topic, the topics are not mutually exclusive, which means that each paper always has a posterior probability of belonging to every topic. The most correlated documents with each topic are those with a higher posterior probability (Blei et al., 2003). First, the papers' full text was transformed into *corpora* using the text mining (*tm)* and the *topic models* packages of R (Hornik & Grun, 2011). The text was then transformed so that the whitespaces and stop-words were removed after converting the text to the lower case. A process of tokenization, which involves splitting the sentences into terms, was then applied, and similar terms were then counted and stored in a document-term-matrix (DTM) (Feinerer et al., 2008). A document-term matrix is a bag-of-words representation of the document and includes the frequency of all the words in each document. A transformation procedure to reduce the sparsity of the matrix was applied following Guerreiro et al., (2016), Blei and Lafferty (2009) and Feinerer et al. (2008). The measures of log-likelihood and perplexity of Griffiths and Steyvers (2004) and Cao et al. (2009) were used to select the number of latent topics. Log-likelihood and perplexity are two measures commonly used to evaluate the LDA. While log-likelihood evaluates how well the latent topics reflect the observed data, perplexity is a measure that shows whether "the model predicts the remaining words in a specific topic after observing part of it" (Guerreiro et al., 2016, p. 113). While a higher log likelihood measure means that the latent topic structure is better to fit the data, a "lower perplexity score indicates better generalization performance" (Cao et al., 2009,

p. 1780). Figure 7 shows the set of possible topics tested in the current paper, which ranged from K=2 to K=60.

(INSERT FIGURE 7 ABOUT HERE)

The results from the models show that the Cao et al. (2009) measure has a first inflexion on K=8, and only achieves its optimal values at K=20. This paper used K=8 to analyze the clusters, given that there is a first inflexion on the variance explained and to use a parsimonious number of clusters for the interpretation (Guerreiro et al., 2016). The LDA Bayesian inference topic model with Gibbs sampling was used to divide the papers into different latent topics (Blei et al., 2003). Using the LDA, each word found in the papers was assigned a posterior probability of belonging to a specific topic. Each paper was then assigned a posterior probability of belonging to each topic.

Table 3 shows the topics extracted using the LDA algorithm, their name, their five most correlated topic terms, the three papers with the highest posterior probability of belonging to each topic, the posterior probability of each paper, and the journal publishing the paper.

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5. Topic description

5.1. Topic 1- Hotel - reuse and reduce

The papers with the highest posterior probability of belonging to this topic were used to analyze how hotels can reduce water, energy, and waste, or how they can reuse materials, including towels, and how to motivate tourists to become involved in

sustainable programs. For instance, in a recent article by Cvelbar et al. (2019), the authors conducted a quasi-experimental study, which revealed that change in the defaults significantly reduced room cleaning, but pro-environmental appeals do not contribute to further reduction of room cleaning. Yet, Gössling et al. (2019) found that the comprehensive elements of descriptive norms, based on factual-procedural-effectiveness knowledge, common identities, reciprocity-by-proxy, and the moral rewards of pro-environmental appeals, can increase towel and bed linen reuse compared to the traditional information displayed in hotel rooms. Another study (Morgan & Chompreeda, 2015) indicates that pro-environmental appeals do not significantly increase hotel guests' towel reuse, but they decrease the room electricity consumption (Dolnicar et al., 2017). The effectiveness of the comprehensive elements of descriptive norms appeals was also tested at an island resort by Moscardo (2019), where the use of social norms, the set of rules about reusing materials and reducing waste, seems more effective in superior rooms than in standard rooms. Current cluster studies are grounded in theories, such as value–belief–norm theory (VBN), the norm activation model (NA), motivation and goal framing, crowding theory, or cognitive dissonance theory. The first two are grounded in norms, where VBN postulates that moral concerns are crucial to evaluate what is right/wrong and elicit environmentally-friendly behavior, and the NA explains behavior through personal norms, awareness of consequences, and attributing responsibility. Motivation and goal framing mean that hedonic, gain, and normative goals frame how people process information and act upon it. Crowding theory assumes that extrinsic incentives for certain kinds of behavior can undermine intrinsic motivation to perform that behavior, whereas cognitive dissonance theory expresses that individuals have an inner drive to keep attitudes and behaviors in harmony.

5.2. Topic 2- Place attachment - visitors

In this topic, place attachment is the core element. Research analyzes how place attachment can change behavior to protect meaningful places (Ramkissoon et al., 2012; Raymond et al., 2011; Ramkissoon et al., 2013; Ramkissoon, 2015). According to Bowlby (1951), place attachment emerges from attachment theory, which derives from studies on the proximity between individuals. However, an emotional attachment is also formed between individuals and animals, destinations, or brands (Ramkissoon & Mavondo, 2015; Ramkissoon & Mavondo, 2017; Ahuvia, 2005; Ball & Tasaki, 1992). In the tourism context, place attachment has been regarded as multidimensional, and this is where place dependence, the functional emotional connection with a place due to its unique characteristics, and place identity, the individual's identification with a place, are the most common dimensions (Hosany et al., 2017; Prayag & Ryan, 2012; Ramkissoon et al., 2013). Other dimensions are place affect, which is the positive and negative emotions felt by tourists (Ramkissoon & Mavondo, 2017), and place social bonding, which refers to interpersonal relationships (Ramkissoon, 2015).

Previous studies have regarded positive experiences, authenticity, motivation, or destination image as the drivers of place attachment, which is where savoring strategy is the mechanism that triggers the process of broadening and building positive emotions (Bryant & Veroff, 2007; Jiang et al., 2017; Prayag et al., 2018). Destination image, experience, and authenticity are the drivers of place attachment and satisfaction, and they contribute directly to tourists' pro-environmental behavior. In contrast with the first topic, centered on the hotel sector, this one deals with the destination and national park tourism.

5.3. Topic 3- Individual awareness

The third topic focuses on norms that contribute to individuals' decision-making for pro-environmental behaviors. Harland et al. (1999, p. 2507) claim that personal norms "reflect commitment with internalized values and are experienced as feelings of personal obligation to engage in a certain behavior." Onwezen et al. (2013, p. 145) add that personal norms are "individual moral convictions which might be used as personal standards to evaluate behavior." Thus, values and beliefs activate personal norms, which trigger individuals' environmentally responsible behavior (Stern, 2000; Han et al., 2017; Han & Hwang, 2017).

Schwartz (1977) claims that values are altruistic, bio-spheric, and egoistic, and involve openness to change. VBN takes these values and considers that they enhance the awareness of consequences and the attribution of responsibility, which in turn influence one's personal moral norms (Stern, 2000). In the current pro-environmental literature, Han (2015) combines VBN and the theory of planned behavior, which is rooted in the theory of reasoned action to create a framework to predict the pro-environmental behavioral intention. In another study, Han and Hwang (2015) suggested a model based on the loyalty concept, which combines Schwartz's (1977) NA in order to analyze delegates' loyalty formation for environmentally responsible conventions. The results highlight that pro-environmental factors enhance the effect of the moral factor on conative loyalty and behavioral loyalty. Later, Han et al. (2018) analyzed cruise tourists and created a framework aggregating cognitive factors, affective drivers, and normative factors, based on cognitions/perceptions (Schwartz, 1977; Stern, 2000) and anticipated emotions (Perugini & Bagozzi, 2001). This effect empowers eco-friendly purchase behavior and recycling behavior while traveling (College youth travelers) (Han & Hyun, 2018). Another study about the cruise sector merged the model

of goal-directed behavior theory (G-DB) by Perugini and Bagozzi (2001) with the NA, and personal norm and desire emerged as significant mediators (Han & Hwang, 2016).

The authors explored different alternatives of combining the meaning of the norms with other theories, which included the TPB and G-DB, in structural models for better understanding of tourists' pro-environmental behavior, as illustrated in the previous examples. Two concepts contribute to linking the constructs of the different theories and the sense of obligation to take pro-environmental actions and anticipate emotions. The first, which refers to the moral obligation to perform an action, is the direct driver of pro-environmental behavior, and the second acts as a mediator between the cognitive constructs and pro-environmental behavior.

5.4. Topic 4- Behavioral intention

These studies tend to focus on the TPB and its extensions by including a small number of other variables to explain behavioral intentions (Hu et al., 2018; Moghimehfar et al., 2018). For instance, Zhang and Wang (2019) found that place emotion has a stronger effect on behavioral intention than the variables of the TPB. Moghimehfar et al. (2018) explored the influence of negotiation through constraints, and found a strong, negative, indirect association between constraints and behavioral intentions.

Zhang and Zhang (2019) compared two different methodologies, the fuzzy-set qualitative comparative analysis (fsQCA) and the PLS-SEM, to predict national park tourists' car use and carless use intentions. The results showed that the pro-driving norm and neutralization techniques have significant positive effects on tourists' car use intention with both methodologies, although fsQCA revealed more nuanced information.

Behavioral intentions and knowledge about climate change do not always match, which means that not all tourists with knowledge about climate change show pro-environmental behavior. Chen et al. (2019) found that an appraisal of the threat of climate change can mediate the relationship between knowledge and behavioral intention. Appraisal is regarded here in light of the construal level theory. Hence, stronger emotions emerge from events that are closer and can cause more reactions following this type of theory. From this topic emerges the relevance of combining emotions with knowledge to enhance pro-environmental behavior indirectly via attitude toward the behavior. Even though knowledge and positive emotions about environmental issues are the indirect drivers of pro-environmental behavior, tourists need to evaluate environmental behavior in a positive way to act effectively in its favor.

5.5. Topic 5- Nature activities-wildlife/outdoor

This topic examines environmentally-damaging behaviors and promotes responsible outdoor recreation (Cooper et al., 2015; Stafford et al., 2018; Blye & Halpenny, 2020). Nature-based recreationists are more willing to adopt pro-environmental conservation behavior than non-nature-based recreationists (Cooper et al., 2015). As people who enjoy outdoor activities have been identified as the great enhancers of pro-environmental behaviors, Cazalis and Prévot (2019) claim that more activities in protected areas can increase pro-environmental behaviors among citizens. Although they demonstrated that the type of recreational activity does not predict behaviors, outdoor and wildlife activities can be seen as a way to promote education for the environment (Hovardas & Poirazidis, 2006; Littlejohn et al., 2016; Cazalis & Prévot, 2019). This topic uses correlations and cross-tabulation and compares different socio-demographic groups to understand what influences a change toward pro-

environmental behavior while demonstrating the fundamental role of education in the context of outdoor and wildlife experiences.

5.6. Topic 6- Organization and employees' behavior

This topic is comprised of articles that present employees' role in contributing to companies' pro-environmental strategies and encouraging tourists to change their behavior (Luu, 2018; Luu, 2019). For instance, Tuan (2019) showed that charismatic leadership in tourist organizations can foster employees and tourists' pro-environmental behavior. The style of leadership is also relevant in developing organizational culture, as this can establish and encourage pro-environmental practices, such as training, empowerment, and rewards for pro-environmental behaviors. Hence, the operating culture facilitates employees' environmental commitment, which in turn affects their green recovery performance (Luu, 2018). Hospitality organizations should be able to handle the relationships among employees to match employees and the organization's pro-environmental values (Luu, 2019). Pro-environmental practices can boost employees' voluntary green behavior (Pham et al., 2019). Likewise, corporate social responsibility (CSR) motive attribution (driven by self-serving for reputation and profit enhancement motives) can strengthen the positive effect of employees' CSR perceptions on voluntary pro-environmental behavior (Afsar et al., 2019).

Personal values and external motivations are regarded as influencing factors that can change behavior inside organizations (Zientara & Zamojska, 2018). Here, employees' environmental commitment is a core variable that mediates between factors such as green training, empowerment, rewards, employee motivations, leadership styles, and pro-environmental behavior. The studies of topic 6 deal with employee motivation, which is supported by self-determination and social identity theories, and mainly use the

SEM approach to test hypotheses. While self-determination theory implies that the individual's motivations are unrelated to external influence, social identity theory considers how individual self-concepts are based on their social groups of belonging.

5.7. Topic 7- Local community awareness

Impoverished communities are often surrounded by protected areas. Thus, benefit-sharing, which includes access to natural resources, employment, infrastructure and training, involvement in natural reserves, communication and environmental education, and economic rewards, should be promoted as a means of fostering positive relationships among citizens, tourists, and protected areas (Queiros & Mearns, 2019; Liu et al., 2014).

Stanford and Guiver (2016) revealed that inspirational leadership is key to citizen, tourist, and employee involvement in projects in favor of pro-environmental behavior. Tourist organizations must also have supportive senior management, strong governance, better visitor experiences, and most significantly, communication of the benefits of change to stakeholders (Minoli et al., 2015).

In sum, this topic covers research analyzing how multi-partner organizations in a community can develop and evolve together without forgetting environmental protection. As the key relevant aspects found in studies include cultural education and communication among community members and environmental education and training, citizens and tourists should enjoy being involved in environmental causes. A trusting atmosphere should be established and maintained in order to facilitate engagement of the whole community. Case studies, focus groups, and interviews are based on social exchange theory (SET) to understand behavioral changes. SET considers a cost-benefit analysis in the relationship between parties in a community.

5.8. Topic 8- Travel transportation

Tourism is associated with the movement of people to countries or places outside their usual environment (UNWTO, 2019). The choice of transport mode is a critical component of tourists' decision and has environmental impacts (Hergesell & Dickinger, 2013; Wynes et al., 2019). Although some transport modes are regarded as more environmentally-friendly than others, including electric cars, hydrogen powered buses, airplanes, cars, and even vehicles used for sport activities connected to tourism, they all have carbon footprints (Alcock et al., 2017; Wicker, 2018). Various studies discuss ways to reduce the carbon footprint, suggesting that tourists should avoid air travel (Alcock et al., 2017). The carbon footprint of active sport tourists is also a target for environmentalists. Wicker (2018) revealed that environmental attitudes are not directly associated with pro-environmental behavior in high-cost situations, where the costs of time, money and convenience of using a more effective carbon-footprint alternative are too high.

Energy efficacy requirements mean tourists should use means of transport other than airplanes (Kim, Filimonau, & Dickinson, 2020). Tourists who voluntarily reduce their holiday air travel are more likely to consider that their behavior using airplanes really contributes to climate change as opposed to those who continue to fly, so they avoid traveling as a moral imperative (Buchs, 2017). Attitudes, norms, and behavior-specific self-identity lead tourists to reduce transportation by air (Davison et al., 2014; Morten, Gatersleben, & Jessop, 2018). The studies focusing on this topic use mainly secondary data from the databases of institutions and organizations, and employ descriptive statistics, associations, and cluster analyses.

6. Overall discussion and implications for future research

6.1. Theory

Our literature review highlights the relevance of six core theories, TPB, reasoned action, VBN, NA, attachment theory, and G-DB (see Figure 4). Norms have been a relevant concept in shaping pro-environmental behavior, and they are included in theories such as TBP, VBN, NA, and G-DB. Psychological factors such as norms, which include individual and social norms, have been regarded as pivotal in studies analyzing pro-environmental behavior. Social norms represent the shared rules approved by society or the group of belonging. Personal norms are moral obligations and correspond to an individual's internal value system (Schwartz, 1977; Esfandiar et al., 2020).

Previous studies also combined theories to support this type of research (Peng & Lee, 2019; Esfandiar et al., 2020). For instance, the integration of TPB and VBN was used to analyze employees' pro-environmental behaviors in Chinese luxury hotels (Peng and Lee, 2019) or to understand visitors' behavior in Iranian national parks (Esfandiar et al., 2020). The combination in the same framework of constructs or group of constructs coming from more than two theories has also been used. For example, a study in the museum context incorporates variables of TPB, reasoned action theory, and the concept of affective commitment into the model of goal-directed behavior to understand visitors' decision-making process (Han, Kim, & Lee, 2018).

Following on from the above analysis, other theories that are rarely employed can be looked at in greater depth in the future, such as self-determination theory, social exchange theory, and expectancy theory (see Figure 4). These theories are not focused on norms. They assume that tourists are self-determined when their needs for autonomy, connection, and competence are fulfilled, involving self-determination theory, and the social behavior of the interaction of two parties, involving social-exchange theory, or

tourists act in a certain way due to the expected result of such an action, which involves expectancy theory.

Secondly, researchers should go further in merging theories that can help to explain pro-environmental behavior. For example, pro-environmental behavior can be a function of motivations, which can be intrinsic/extrinsic, values/beliefs, emotions/attachment, and norm activation.

Finally, other theories and models besides those already used can be explored. A new theory specific to the environmental context can be proposed. For instance, the Fogg Behavior Model (FBM) (2003), created as a practical guide to maximize motivation, and the use of goods/services can be adapted to the pro-environmental context. This model regards behavior as being influenced by motivation, ability, and a prompt. Motivations involve how an individual is willing to engage in a behavior, ability measures how easy/hard it is to engage in a behavior, and the prompt is the stimulus that drives the action. Thus, the FBM proposes that after experiencing a stimulus, individuals who have enough motivation and ability will perform the behavior.

6.2. Characteristics

A growing number of researchers have explored the constructs associated with the main theories, such as TPB, VBN, attachment theory, or GD-B. Therefore, the constructs most often found in the articles are connected to those theories, including individual values, social values, subjective values, attitude, perceived behavior control, place attachment, and anticipated emotions. Other constructs have not been studied as frequently, and have been analyzed in specific situations, such as satisfaction, life satisfaction, or bio-spheric value.

Satisfaction is a construct that emerges mainly in studies based on attachment theory (Chen et al., 2018; Ramkissoon et al., 2018). The role of satisfaction depends on the type of study. For instance, satisfaction is a mediator (Ramkissoon et al., 2013; Ramkissoon, 2015), a moderator (Ramkissoon et al., 2012), and a driver of pro-environmental behavior (Ramkissoon & Mavondo, 2015; Ramkissoon, & Mavondo, 2017), or it is an outcome of positive cognitive and emotional evaluations (Prayag, et al., 2018).

Leelakulthanit (2019) uses the concept of life satisfaction as an outcome of eco-friendly behavior. The bio-spheric value, as the ascription of responsibility, and the awareness of consequences are constructs incorporated in VBN theory (Schwartz, 1977; Stern, 2000). They are also analyzed in diverse contexts, such as green lodging (Han, 2015), cruises (Han, Olya, Kim, & Kim, 2018), or young travelers (Han, Kim, & Kiatkawsin, 2017). Demographic characteristics, including age and gender, are analyzed as the moderator or as antecedents (Ramkissoon & Mavondo, 2015; Gössling et al., 2019). Diverse emotional and psychological variables are also considered, such as guilt, delight, altruism (Kim & Stepchenkova, 2019), mindfulness (Dharmesti, Merrilees, & Winata, 2020), memory, and nostalgia (Wu & Geng, 2020).

Regarding the outcomes, pro-environmental behavior (PEB), pro-environmental behavioral intentions (PEBi), and environmental concerns are the most used, but some articles also considered behavioral intentions, word-of-mouth, willingness to sacrifice/sacrifice behavior, or commitment (Kim & Yun, 2019; Han et al., 2019; Terrier & Marfaing, 2015).

Considering the above analysis, other constructs should be explored, such as the customer's adaptation and employee engagement with respect to recycling, sustainability, or pro-environmental behavior (Kumar & Pansari, 2016). More studies

should use mindfulness as a driver or moderator (Dharmesti et al., 2020) or as memory and nostalgic concepts (Wu & Geng, 2020). Emotional states, which are moods and relational variables, should be incorporated in the models, including love, fear, delight, fear, pride, and a feeling of awe. For example, animosity and irritation toward a destination, due to a low level of concern regarding pro-environmental and sustainability issues, can also be analyzed as a mechanism used to change behaviors and to encourage local entities and citizens to create strategies to change behaviors (Russell & Russell, 2010). Some of the ten dimensions of brand coolness can be considered in the destination perspective (Warren et al., 2019). The fact that a certain behavior is regarded by tourists as cool can lead them to change their behaviors. Finally, future research can explore ways to measure actual pro-environmental behavior instead of the intention behavior.

Can research questions consider how to engage citizens and tourists actively in changing their behavior? What other dependent constructs besides pro-environmental behavior may be considered to understand the phenomenon? What other moderators may be used to explain pro-environmental behavior? Can they be connected to individual or social characteristics or emotional states, such as regret and guilt?

6.3. Methodology

The most common methodology is the primary data survey using convenience samples and between 300 and 500 participants. Only five articles used secondary data (Stafford et al., 2018; Cazalis & Prévot, 2019). Structural equations or multiple regressions (Zhang et al., 2019; Qu et al., 2019) are the most commonly used analytical methods in the literature. With regard to structural equations, the covariance approach (CB-SEM) is more often employed than variance approach (PLS-SEM) (Filimonau et al., 2020).

Experiments involving the manipulation of variables to determine if changes in one variable will cause changes in another, a technique that requires controlled methods and random assignment, are not common in the articles analyzed. The qualitative approach emerges in exploratory studies conducted through semi-structured interviews (Stanford & Guiver, 2016; Hunt & Harbor, 2019) and focus groups (Miller, 2018). One study uses ethnography (Wang, Wu, Wu, & Pearce, 2018). The mixed method approach usually considers surveys and interviews (Pham, Tuckova, & Jabbour, 2019; Gupta, Dash, & Mishra, 2019). The conceptual papers present theoretical frameworks (Hale, 2019; Kim, Filimonau, & Dickinson, 2020).

The above analysis reveals many opportunities for research in this area of pro-environmental behavior using other methodologies, such as case studies, mixed methods, experiments, ethnographies, netnographies, storytelling, text mining, and FcQCA.

Content analysis using netnography or text-mining can be useful when embarking on new research directions, because it uses information from websites and social media. More research is encouraged with emphasis on developing the theory, which is grounded theory, because previous studies tend to apply and extend well-known theories from psychology and sociology. More studies should include the firm-level, the community-level, or use different levels of analysis, and they should not focus only on tourists, visitors, or travelers.

New technologies, such as virtual reality, augmented reality, and artificial intelligence should also be employed as the interfaces to conduct experiments, simulate experiences, and understand new tourism opportunities. A few studies explore the use of virtual environments as autonomous agents to promote tourism destinations (Bishop & Gimblett, 2000), and more recent examples have increased discussion of the role of

mobile technology, artificial intelligence, and AR/VR in sustainable and smart tourism (O'Dwyer et al., 2019).

Some future methodological directions should be more explored, such as how VR/AR/AI and other technologies can contribute to changing behavior. How can big data be better explored with text mining and machine learning techniques to (1) structure textual opinions about consumers' pro-environmental behavior and (2) predict real pro-environmental behavior from the Internet of Things (IoT sensors), such as hotel energy consumption and sensors used to measure how each customer uses natural resources inside the hotel. Can grounded theory be useful to develop a prototype of pro-environmental behavior that accommodates these new technologies?

7. Conclusion

Pro-environmental behavior in tourism and hospitality has become a hot topic among scholars and tourism managers. Despite its importance, the current paper is the first to make an in-depth analysis of the most important topics discussed in the existing literature and to highlight potential avenues for research on pro-environmental behavior in tourism and hospitality. Therefore, it contributes to the literature by (1) using a recent and advanced methodological approach based on text mining to analyze the full-text of extant research and (2) suggests further theories (T), contexts (C), characteristics (C) and methodologies (M) that can be explored in the topic. The results show that currently, studies tend to use more quantitative (surveys) than qualitative approaches. Structural equations or regression analyses are among the techniques used most to analyze data, and researchers tend to employ well-known theories, mainly coming from other fields such as psychology, sociology, and biology to support their studies. Most studies focus on the domain of lifestyle conservation, which is related to recycling and

using resources efficiently. Thus, implementing recycling, energy saving, and waste reduction to make hotels and destinations more sustainable has been the main area of research, followed by concerns about the behavior of local people or tourists in wildlife and educational programs.

The paper can also help destination managers, hotel managers, and other related managers by highlighting the most relevant issues that can affect pro-environmental behavior. Some examples include the relevance of tourists and guests' values and beliefs in explaining pro-environmental behavior. We can also highlight the role of emotions and the social and moral norms that make tourists and guests more active about changing their behavior. At the destination and hotel level, the results highlight the need for managers to spread messages to raise tourists and the guests' awareness of pro-environmental behaviors, which can involve employees and citizens for the same purpose.

Despite the contributions of the current paper, there are some limitations. First, the search query was focused on the well-known pro-environmental behavior construct. Other related terms such as *environmental behavior*, *ecological tourism*, *ecological behavior* or *eco-tourism* were not used, which restricts the results to pro-environmental behavior implications. Finally, the studies were focused on behaviors in general and not behavior changes in particular, which is also a very relevant topic for tourism and hospitality and may be explored in more detail in future research.

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Table 1. Queries used to collect the articles about pro-environmental behavior	**Query**
Scopus	(TITLE-ABS-KEY("pro environmental behavior*" or "pro environmental behavior*" or "pro-environmental behavior*" or "pro-environmental behavior*") AND (tourism or hospitality))
Web of Science	TS=(("pro environmental behavior*" or "pro environmental behavior*" or "pro-environmental behavior*" or "pro-environmental behavior*") AND (tourism or hospitality))

Table 2. Authors with at least 3 papers about PEB in hospitality and tourism Author	**Number of Papers**
Han H.	22
Ramkissoon H.	11
Dolnicar S.	8

Kim W.	8
Kim J.	7
Halpenny E.A.	6
Hyun S.S.	5
Zhang, J	5
Hwang J.	5
Mair J.	4
Kim S.	4
Mavondo, F	4
Weiler B.	4
Lee C.-K.	4
Ryu H.B.	3
Moghimehfar F.	3
Zhang Y.	3
Leisch F.	3
Grün B.	3
Hunt C.	3
Smith L.D.G.	3
Filimonau V.	3
Gupta, A	3
Miao L.	3
Zheng, CH	3
Lee S.	3

Table 3. Latent Topics and Papers with the highest posterior probability of belonging to each topic

Topic Name	Topic Terms	Top 3 Correlated papers with topic	Posterior Probability	Journal
T1. Hotel-reuse and reduce	Hotel, guests, water, recycling, environmentally, reuse, friendly, message, social, destination	Morgan & Chompreeda (2015)	0.76	Environmental Communication
		Terrier & Marfaing (2015)	0.76	Journal of Environmental Psychology
		Cvelbar et al. (2019)	0.75	Journal Of Travel Research
T2. Place attachment-visitors	Place, attachment, destination, satisfaction, visitors, identify, park, relationship, intentions, experiences	Ramkissoon (2015)	0.81	Development Southern Africa
		Ramkissoon, Smith & Weiler (2013a)	0.80	Tourism Management
		Ramkissoon, Smith & Weiler (2013b)	0.77	Journal of Sustainable Tourism
T3. individual awareness	Norm, behaviors, intention, personal, responsibility, awareness, han, norms, moral, consequences	Han, Hwang & Lee (2017)	0.91	Journal of Travel and Tourism Marketing
		Han & Hwang (2015)	0.87	International Journal of Hospitality Management
		Han et al. (2018)	0.86	Business Strategy and The Environment
T4. Behavioral intention	Intention, behavioral, attitude, intentions, tourists, perceived, tpb, influence, norms, effect	Hu et al. (2018)	0.73	Waste Management
		Zhang & Zhang (2019)	0.72	Tourism Geographies
		Moghimehfar et al., (2018)	0.69	Leisure Sciences

		Blye & Halpenny (2020)	0.77	Journal of Outdoor Recreation and Tourism
T5. Nature activities-wildlife/outdoor	Nature, visitors, knowledge, behaviors, wildlife, natural, education, conservation, park, tourists	Cooper et al. (2015)	0.76	Journal of Wildlife Management
		Stafford, Welden & Bruyere (2018)	0.72	Wildlife Society Bulletin
T6. Organization and employees' behavior	Green, employees, hotels, hotel, practices, behaviors, performance, environment, motivation, management	Tuan (2019)	0.87	Journal of Hospitality and Tourism Research
		Luu (2018)	0.87	Journal of Sustainable Tourism
		Luu (2019)	0.86	International Journal of Contemporary Hospitality Management
T7. Local community awareness	Community, local, social, sustainable, development, cultural, sustainability, benefits, residents, economic	Sacco, Ferilli & Blessi (2018)	0.75	Sustainability
		Queiros & Mearns (2019)	0.74	Journal of Sustainable Tourism
		Minoli, Goodle & Smith (2015)	0.73	Tourism Management Perspectives
T8. Travel-transportation	Travel, change, climate, air, time, number, food, energy, carbon, emissions	Hergesell & Dickinger (2013)	0.77	Journal of Sustainable Tourism
		Wynes et al. (2019)	0.77	Journal of Cleaner Production
		Wicker (2018)	0.72	Journal of Sport and Tourism

Appendix A

Element	0: Absence	1: Low level	2: Medium level	3: High level	Not Applicable
1. Directly related to the objective of the research	There is not enough information to evaluate this criterion	Not related	Somehow related	Totally related	Not Applicable
2. Theory robustness	There is not enough information to evaluate this criterion	Weak development of literature	Superficial development of theories and constructs within existing literature	Robust use of theory	Not Applicable
3. Congruence of theory, methodology and findings	There is not enough information to evaluate this criterion	Incomplete data and not related to theory	Data somehow related to the arguments	Strong link between the arguments presented and data	Not Applicable
4. Contributions to theory and/or practice	There is not enough information to evaluate this criterion	Makes a low contribution	Makes a medium contribution	Makes a high contribution	Not Applicable

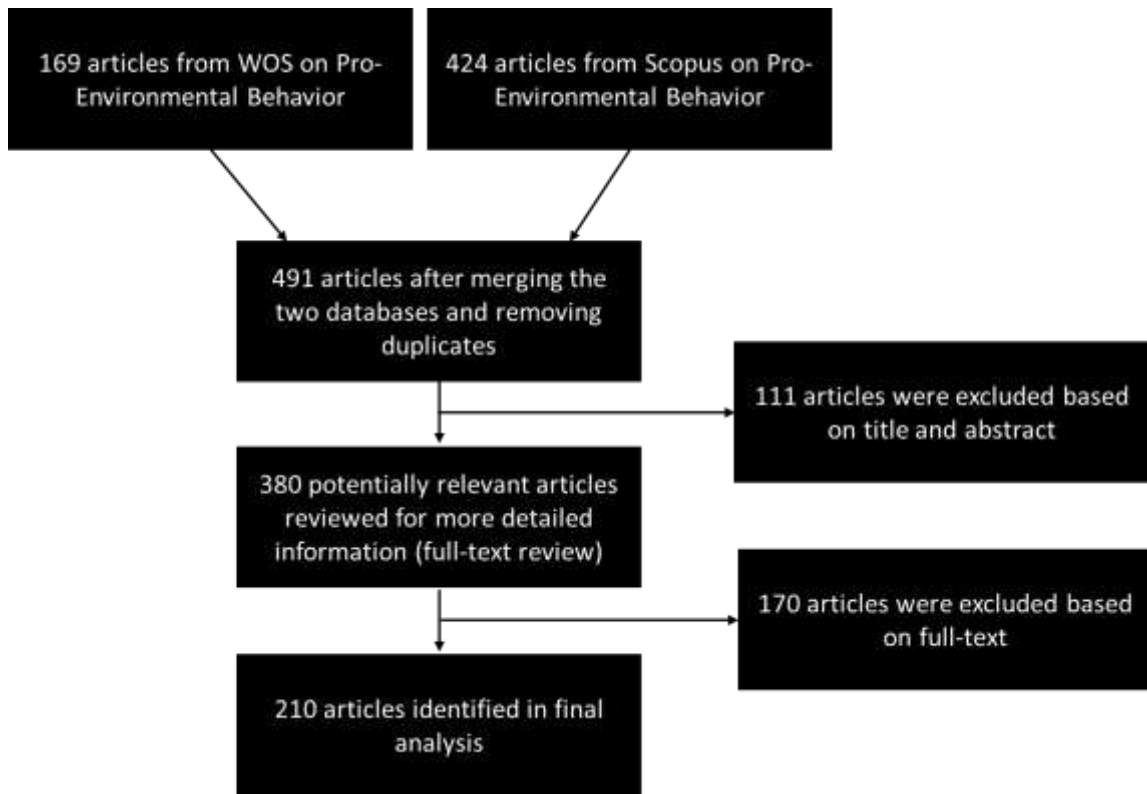Source: Adapted from Macpherson & Holt (2007).

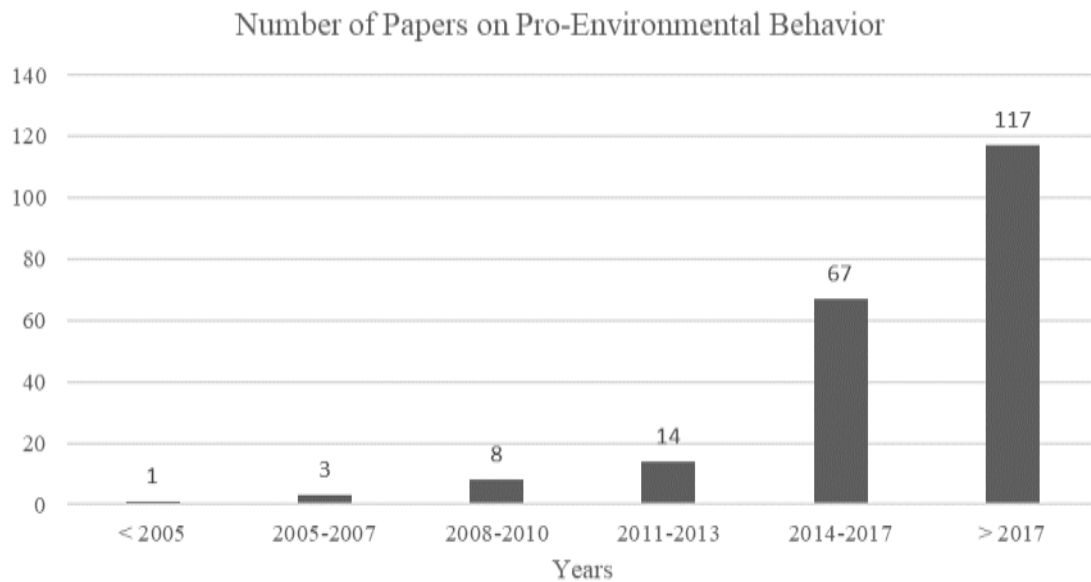Fig. 1. Screening process for selecting the final papers for analysis

Fig. 2. Number of papers published over the years on pro-environmental behavior
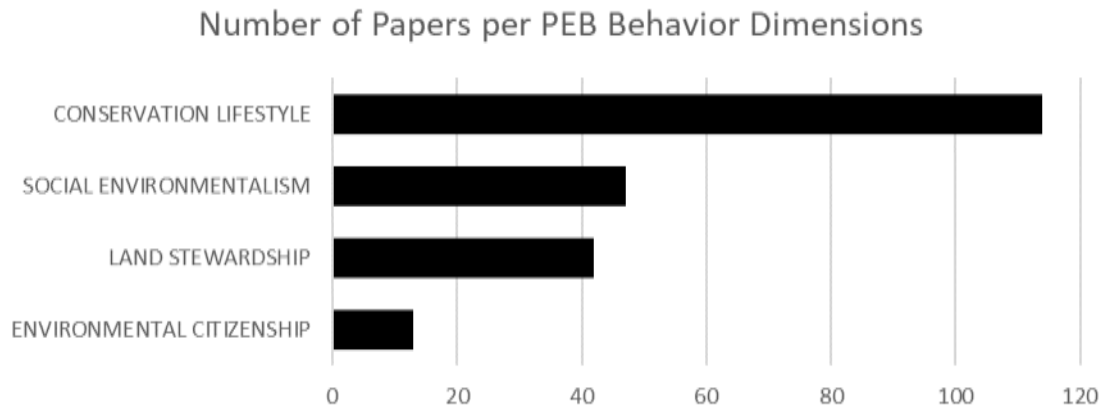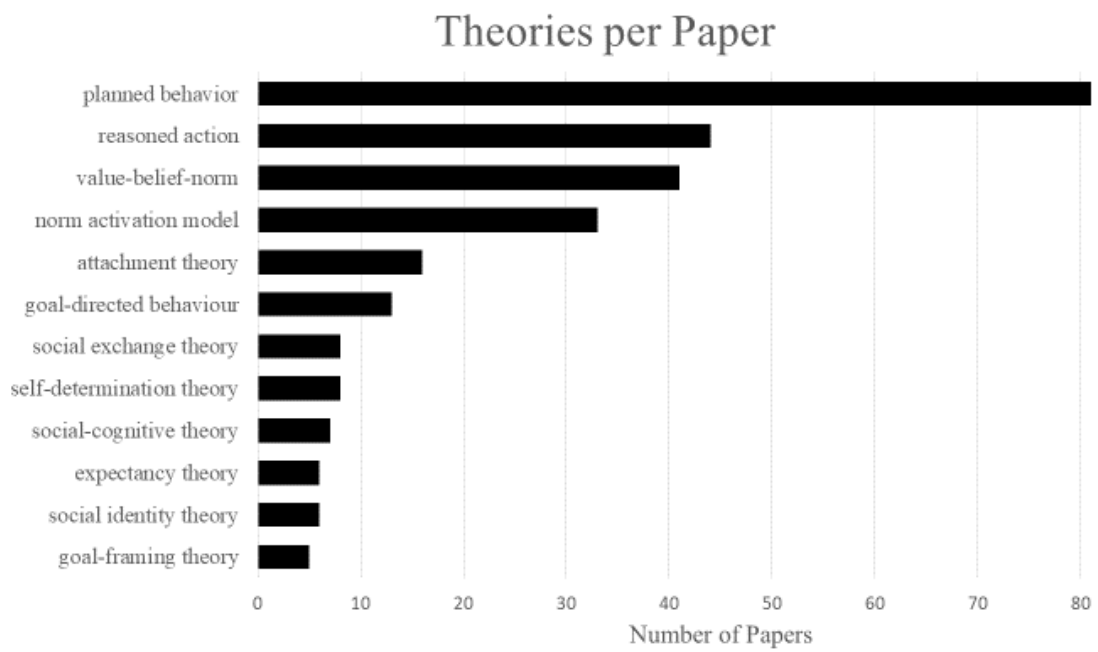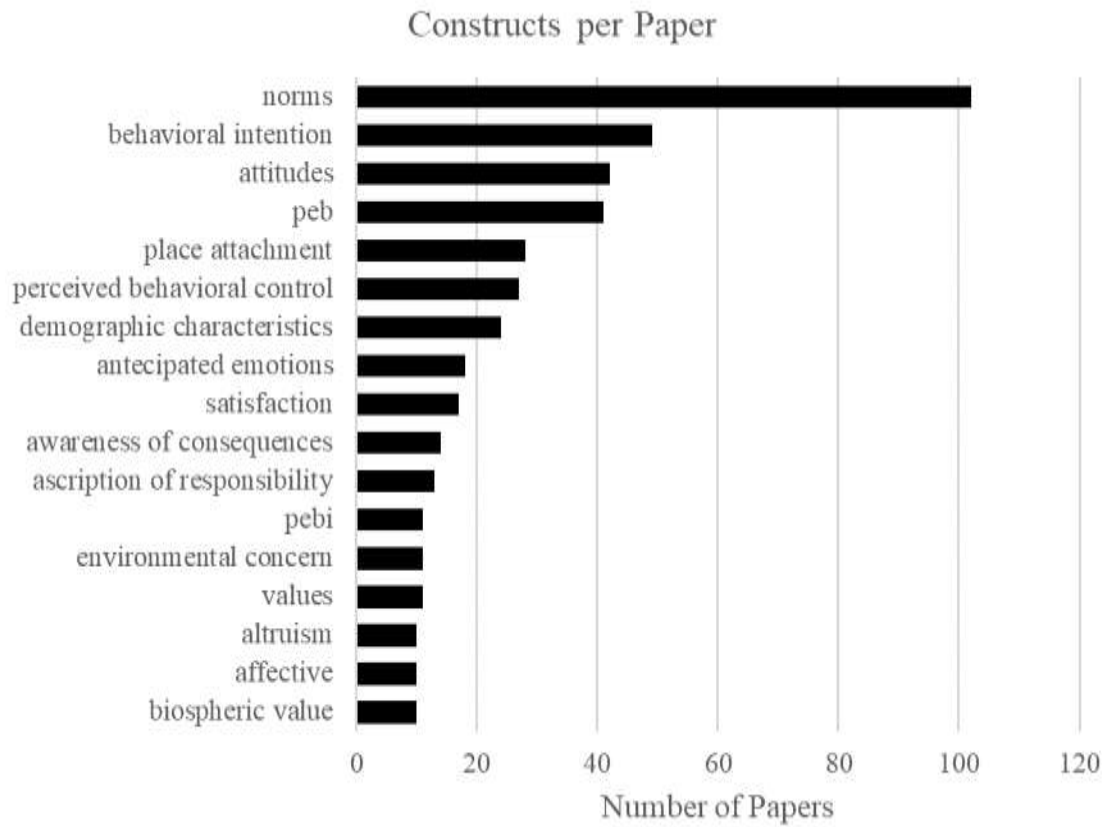
Number of Papers per PEB Behavior Dimensions

Fig. 3. Pro-environmental domains

Theories per Paper

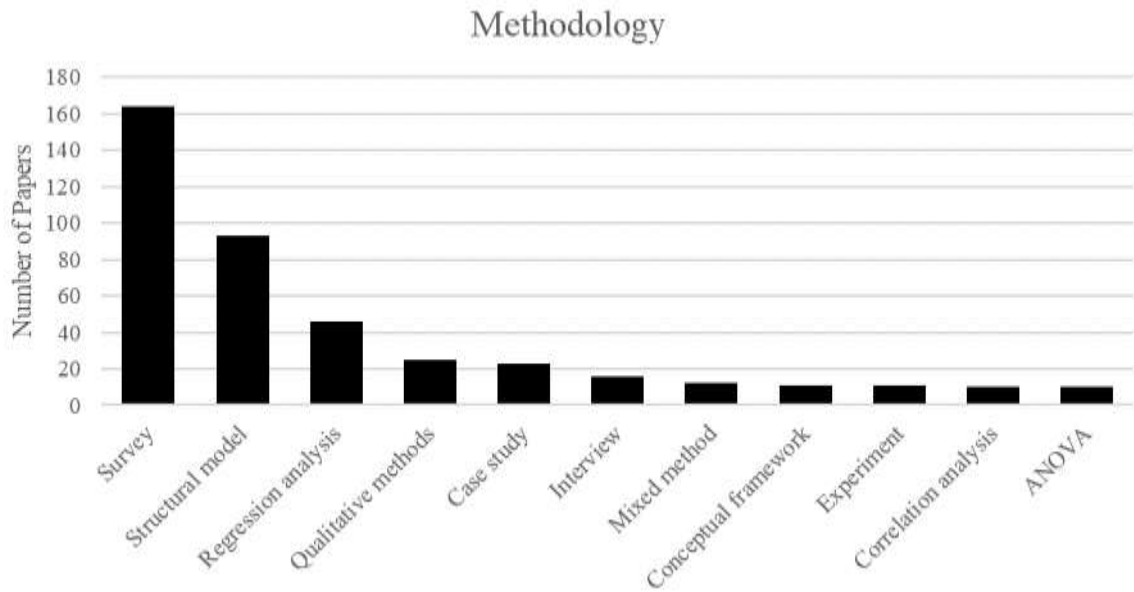Notes: theories identified in at least 5 papers.

Fig. 4. Theories used in the PEB papers on hospitality and tourism

Fig. 5. Constructs per Paper

norms
behavioral intention
attitudes
peb
place attachment
perceived behavioral control
demographic characteristics
antecipated emotions
satisfaction
awareness of consequences
ascription of responsibility
pebi
environmental concern
values
altruism
affective
biospheric value

Number of Papers

Notes: 1. the constructs were identified in at least 10 papers; 2. peb=pro-environmental behavior; 3. pebi=pro-environmental behavior intention

Fig. 5. Constructs identified in pro-environmental behavior papers in hospitality and

tourism

Methodology

Fig. 6. Methods identified in pro-environmental behavior papers in hospitality and
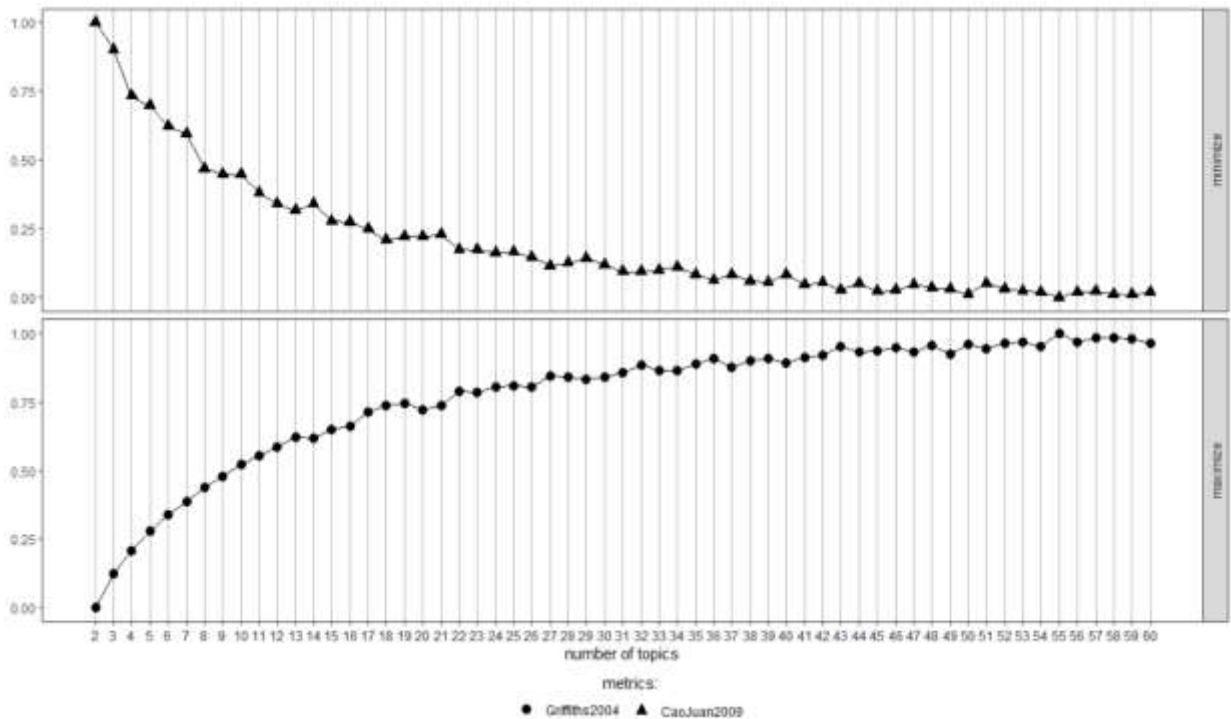
tourism

metrics:
● Griffiths2004　▲ CaoJuan2009

Fig. 7. Log-likelihood and perplexity metrics to evaluate K