The sustainable transformation of business events: sociodemographic variables as determinants of attitudes towards sustainable academic conferences

Received 29 June 2022
Revised 5 October 2022
4 November 2022
Accepted 7 November 2022

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Abstract

Purpose – This study aimed to assess whether sociodemographic variables explain significant differences in attitudes towards transforming academic conferences into more sustainable events.

Design/methodology/approach – An analytical model of participants' attitudes towards sustainable conferences based on literature review as well as the theories of reasoned action and planned behaviour was developed and applied to a sample of 532 surveyed individuals from 68 countries who regularly attended academic conferences in the last five years prior to 2020. The results were refined using statistical and computational techniques to achieve more empirically robust conclusions.

Findings – Results reveal that sociodemographic variables such as attendees' gender and age explain differences in attitudes. Women and older adults have stronger pro-environmental attitudes regarding event sustainability. On the other hand, attitudes towards more sustainable academic conferences are quite strong and positive overall. More sustainable events' venues, catering, conference materials and accommodations strongly influence attendees' attitudes towards more sustainable conferences. The strength of attitudes was weaker towards transportation.

Research limitations/implications – First, the analyses focused on only aspects related to the attendees' attitudes. Assessing their real behaviour would complete this research. The geographical areas defined by the U.N. and used in this study have the limitation of combining highly developed countries and developing countries in the same geographical area, for example, the Americas and Asia and the Pacific.

This paper is financed by F.C.T.—Foundation for Science and Technology through project UIDB/04020/2020.

Disclosure statement: The authors disclose any conflict of interests.

International Journal of Event and Festival Management
Vol. 14 No. 1, 2023
pp. 1-22
Emerald Publishing Limited
1758-2954
DOI 10.1108/IJEFM-05-2022-0041

Practical implications – Specific socio-demographic variables' effects on attitudes towards sustainable academic conferences can indicate how organisers can best promote these events according to attendees' characteristics and develop differentiated marketing campaigns. For women and older adults, event sustainability should be emphasised as a competitive strategy to promote events and attract these audiences. Marketing strategies for younger attendees (under 30 years old) could focus on technology, networking or attractive social programmes. Sustainable venues, catering, conference materials and accommodations are easier to promote. Event organisers should encourage participants to make more environmentally friendly decisions regarding more sustainable event transport.

Social implications – A strategy based on promoting the event as contributing to sustainable development could educate attendees and put them on the path to developing stronger positive attitudes regarding sustainability and more sustainable behaviours. Sustainable academic conferences can educate students, organisers, service providers and delegates through their involvement in sustainable practices.

Originality/value – To our best knowledge, this research is the first to assess whether sociodemographic variables explain significant differences in attitudes towards the sustainable transformation of academic conferences.

Keywords Sustainable transformation, Event sustainability, Sustainability attitudes, Sustainable business events, Sustainable academic conferences

Paper type Research paper

1. Introduction

Events play a significant role as tourism motivators and drivers of socio-economic development, as they are a powerful marketing tool to attract tourists to the host regions (Amorim *et al.*, 2021; Dalgiç and Birdir, 2020). In event tourism, planned events are created to serve a specific purpose. They are currently subdivided into business events (i.e. meetings, incentives, conferences and exhibitions), festivals and culture, entertainment, and sports (Getz and Page, 2016). The business events industry is quite sizable worldwide and represents a significant tourism segment. Most large cities and tourism destinations have made an effort to attract these demanding tourists due to their considerable market size and because business tourists spend more than most types of travellers (Crouch *et al.*, 2019).

Events also cause negative impacts, especially on the environment, as they are major sources of greenhouse gas emissions, pollution and waste (Dickson and Arcodia, 2010). Yuan (2013) distinguishes between three types of event-related environmental impacts. The first is resource usage impacts connected to the use and depletion of physical materials and spaces, water and energy. The second type comprises waste and pollution impacts, such as ecosystem destruction, poor air quality, increased noise, diminished aesthetics and water pollution. The last type consists of behaviour-related impacts regarding food, accommodations and transport.

The United Nations clearly defines event sustainability, stating that "a sustainable event is one designed, organised and implemented in a way that minimises potential negative impacts and leaves a beneficial legacy for the host community and all involved" (UNEP, 2009, p. 9). This means that events should leave a long-lasting positive impact on the host region and all stakeholders involved, contributing to sustainable development (Mair and Smith, 2021).

Event sustainability must necessarily encompass the triple bottom line framework, i.e. the balanced positive output of interconnections between events' economic, socio-cultural and environmental impacts on society, stakeholders, and the surrounding region's development (Mair and Smith, 2021; Raffay-Danyi and Formadi, 2022). Events can contribute to destinations' economic and social sustainability, especially if off-season, thus helping to maintain economic activities and jobs when they are most needed in tourism regions (Dalgiç and Birdir, 2020; Santos *et al.*, 2020a; Sox *et al.*, 2013). Revenues generated by event tourism, especially off-season ones, reduce unemployment, improve destinations' infrastructure, increase local people's well-being, ensure social cohesion (Akgunduz *et al.*, 2020; Domareski-Ruiz *et al.*, 2020) and contribute to destinations' competitiveness (Amorim *et al.*, 2021; Santos *et al.*, 2020a). Sustainable consumption with a clear preference for locally sourced

products and sustainable production practices contributes to economic, social and environmental sustainability (Santos *et al.*, 2020b).

According to Mair and Whitford (2013), the early literature on events' effects mainly focused on their economic impacts. More recently, increased attention has been given to assessing the socio-cultural impacts (Colombo, 2016; Stevenson, 2021) and the environmental impacts (Collins *et al.*, 2009; Maguire, 2022; Toscani *et al.*, 2022) of events. Other researchers assert that although the environmental dimension of events' sustainability has been examined more often in recent years, this topic still needs further investigation (Getz and Page, 2016; Harris and Schlenker, 2018). On the other hand, event sustainability has been identified among the relevant topics of event research (Backman, 2018; Mair and Whitford, 2013).

The sustainable transformation has become a much-debated topic among researchers and policy-makers concerning the urgency to deal with the current sustainability challenges effectively and fundamentally (Salomaa and Juhola, 2020). Therefore, several authors recognise the need for a sustainability transformation across all sectors of human activity (Elmqvist *et al.*, 2019). According to Olsson *et al.* (2014), a sustainability transformation will require radical systemic shifts in multilevel governance and management regimes, involving drastic changes in values, beliefs and behaviour towards sustainability. The business events industry needs a profound, sustainable transformation along with the broader tourism industry. Conferences belong to business events and, along with conventions, are among the fastest-growing areas of the events industry (Mair, 2013). Academic conferences are events organised by universities and associations that focus on presenting, discussing and sharing the results of academic research (Holden *et al.*, 2017; Neugebauer *et al.*, 2020). Additionally, academic conferences foster research collaborations and working relationships worldwide among researchers, practitioners and academic institutions.

To transform academic conferences into more sustainable events, all involved stakeholders representing supply (organisers, the hosting community, event suppliers and sponsors) and demand (attendees) should be taken into account (Yuan, 2013). Sustainable events must address the needs of all involved stakeholders (Holmes *et al.*, 2015). Event organisers can play a crucial role in transforming academic conferences into sustainable events by designing them based on sustainability principles (Toscani *et al.*, 2022; Yuan, 2013). However, sustainable event proposals that only consider the supply side will not guarantee success. Above all, organisers must take the demand side, the attendees as end users of the service (Toscani *et al.*, 2022), into account, especially the target audience's attitudes regarding practices that contribute to event sustainability. Accordingly, the product offered has to be adapted to match the attendees' wishes and expectations (Raffay-Danyi and Formadi, 2022). It is a basic marketing principle to consider the desires and expectations of the customer for the success of a product or service (Mair, 2010). Additional reasons for considering attendees' wishes and expectations are the increasing offer of academic conferences in nearly all disciplines, the decreasing funds for attendee participation and the increasing self-financing of travel and participation costs associated with conference attendance (Mair *et al.*, 2018). A review of the relevant literature revealed that this is one of the few studies that has evaluated event attendees' attitudes towards sustainable events and is the first to assess the differences in attitudes towards sustainability practices derived from sociodemographic variables of the target audience of academic conferences.

This study attempts to answer the following question: Is there a significant relationship between attendees' sociodemographic characteristics and their attitudes towards the sustainable transformation of academic conferences? To address this research gap, the present research focused on assessing whether sociodemographic variables, such as the target audience's gender, age, geographical area of residence and research field, explain differences in attitudes towards the sustainable transformation of academic conferences.

An analysis model was developed and applied to data from a survey of a sample of 532 individuals from 68 countries who regularly attended academic events in the last five years

before 2020. The results were refined using statistical and computational techniques to achieve more empirically robust conclusions.

2. Literature review

2.1 Sustainability practices for the sustainable transformation of events

In the following, we will review the sustainability practices, which have been clustered into five groups and included in the research questionnaire.

2.1.1 Transport. Air travel has the highest carbon footprint in tourism (Higham *et al.*, 2022), and the same applies to events, especially when participants use air transport to travel to the event and return home. Encouraging the use of public transportation with a low environmental and social impact to travel to and from the event can be seen from a win-win perspective, i.e. it contributes to the event sustainability and, at the same time, it adds to the economic sustainability of a sustainable means of transportation (Chirieleison *et al.*, 2020). Encouraging carpooling for attendees through the event's website can reduce not only each person's travel costs but also carbon emissions, traffic congestion and the need for car parking. Carpooling can be very useful for attendees travelling in small groups by car from home to the event or from home to the departure airport (Collins and Cooper, 2017). In order to implement an effective carpooling system, attendees should be contacted in advance to encourage and organise carpooling whenever possible or to recommend the most environmentally friendly connections available.

Sustainable practices related to transport to and from events seem to be challenging to implement, as suggested in a study by Mair and Laing (2013). This topic still needs additional research.

2.1.2 Venue. The venue should be easily reachable by public transport (UNEP, 2009). An ideal situation would be that venue and accommodation would be in the same infrastructure to avoid any transportation needs or situated within walking distance from one another and from the main attractions (UNEP, 2009). On the other hand, the venue should have a clear and committed environmental policy encompassing all organisation's activities with a strong environmental impact and effective communication with staff and guests to encourage pro-environmental behaviour. Preference should be given to venues with an environmental certification issued by an internationally recognised system or organisation (UNEP, 2009). Sox *et al.* (2013) study revealed that event planners are willing to pay more to hold events at venue facilities with environmental certification.

On the other hand, attendees are willing to pay more for sustainable meetings (Sox *et al.*, 2013). Myung (2018) concluded that attendees with higher environmental attitudes were more likely to pay more for sustainable events. Energy-efficient venue buildings should minimise the use of energy by taking advantage of daylight and using energy-efficient systems in lighting and air conditioning (UNEP, 2009).

Event venues produce large quantities of waste, mostly related to the food and drink services provided by the venues (Hottle *et al.*, 2015), which, if properly recycled, can minimise the events' environmental impacts (Dickson and Arcodia, 2010). In fact, food waste sent to landfill produces greenhouse gases as it breaks down (UNEP, 2009). An effective waste management system consisting of recycling and composting is needed to minimise the waste's environmental impacts and, on the other hand, transform waste into a new resource in a circular economy system (Dolf and Teehan, 2015). A few studies show that separating waste in events is commonly rated high (Mair and Laing, 2013; Raffay-Danyi and Formadi, 2022; Sox *et al.*, 2013). Recycling provides, according to Hottle *et al.* (2015, p. 86) "the greatest reductions in CO_2 eq. emissions and energy use because of the retention of high value materials", while composting, especially of food waste is also relevant but can present a high level of contamination if not properly sorted. The correct use of recycling bins for the different types of recyclable waste, such as plastic, metals, glass or paper, is necessary. The colours of

the recycle bins, as well as signage, are essential for the correct use of the recycle bins. Recycling is common in many events and is also rated high by event attendees (Mair and Laing, 2013; Raffay-Danyi and Formadi, 2022; Sox *et al.*, 2013).

Another condition is the environmental education of the event attendees (Harris and Schlenker, 2018; Hottle *et al.*, 2015). Events can play a crucial role in the environmental education of participants as pro-environmental learning spaces (Mair, 2014) by promoting a green message (Laing and Frost, 2010). On the other hand, the environmental education of the professionals involved in meetings and events is crucial in introducing sustainability into the event organisation (Presbuty and Edwards, 2005).

2.1.3 Catering. It is a fact that large hotels and convention centres procure their food products from large suppliers to ensure continuous supply and reduce purchasing costs (Harrison *et al.*, 2019) and are, therefore, reluctant to include local food in their menus (Santos *et al.*, 2020b). However, the responsible sourcing of local products is a more sustainable practice. From the sustainability viewpoint, paying attention to the meals' composition, food sources and food type could make the event more sustainable (Neugebauer *et al.*, 2020). Integrating local fresh products as much as possible into meals and coffee breaks would be a way to minimise the impacts of transportation and refrigeration of products and, on the other hand, increment more sustainable local production (Fernández-Gámez *et al.*, 2020; Santos *et al.*, 2020b). Responsible catering should give preference to seasonally available ingredients, reduce foods of animal origin and, when using them, ensure that they are produced to high animal welfare and environmental standards (UNEP, 2009). Event catering should also include organic and vegetarian menu options not only to meet the needs of minority consumers, whether for religious, cultural or medical reasons, but also because organic and vegetarian foods have lesser impacts on the environment (Boggia *et al.*, 2018; Neugebauer *et al.*, 2020).

The available research presents contradictory findings on local food consumption at events. In a study on attendee perceptions of green meetings, eating local food was rated high (Rittichainuwat and Mair (2012). Conversely, in another study, festival attendees showed no interest in locally sourced food products (Raffay-Danyi and Formadi, 2022).

2.1.4 Conference materials. Conference materials such as proceedings, booklets, printed materials and bags could be limited or avoided (Neugebauer *et al.*, 2020) and replaced by electronic publications and electronic communication. However, recycled paper and double-sided printing should be used when printing is unavoidable. If signage, badge holders and other materials are inevitable, they should be reused at the next event. When participant bags and/or packs, banners, gifts and other relevant items are used, preference should be given to organic or recycled materials (UNEP, 2009).

2.1.5 The accommodation. Hotels are intensive users of resources such as energy and water and generate considerable amounts of waste. Energy efficiency can be achieved through energy-efficient devices for lighting, cooling and heating (Santos *et al.*, 2019; UNEP, 2009). Water conservation is essential because potable water is becoming scarce in many tourism destinations due to climate change. Some effective water-saving systems are water-efficient showerheads, waterless urinals, low-flush toilet systems and flow-controlled taps (Santos *et al.*, 2019). Waste reduction and recycling also belong to sustainable best practices, as most waste produced in the accommodation industry consists of recyclable resources, such as food, plastics, glass and paper (Santos *et al.*, 2019; UNEP, 2009). Effective sustainability communication, including sustainability certification, is a fundamental marketing tool for decision-making when choosing conference accommodation.

2.2 Sociodemographic variables and attitudes towards sustainability

In particular, sociodemographic variables are especially significant in explaining people's attitudes and behaviours towards sustainability (Bloodhart and Swim, 2020; Park *et al.*, 2012).

Several studies demonstrate that women have stronger positive attitudes towards sustainability. Women's more sustainable attitudes and behaviours may be embedded in larger lifestyle practices and social identities and more likely related to private-realm aspects of living and culture, such as consuming less water and energy (Bloodhart and Swim, 2020; Zelezny *et al.*, 2000). Men's behaviour is more likely to be driven by status (Bloodhart and Swim, 2020) and a higher affinity towards cars and technology, leading to more intensive car use in urban mobility (Kawgan-Kagan, 2020) and more unsustainable consumption.

There are contradictory findings concerning the relationship between sustainable attitudes and age. Some studies (Fermani *et al.*, 2016; Raffay-Danyi and Formadi, 2022; Roberts, 1996) showed that older adults' concerns about sustainability are greater than those of the youngest individuals. Other studies (Van Liere and Dunlap, 1980; Jones and Dunlap, 1992) found an inverse relationship between these variables, concluding that younger people have stronger pro-sustainability attitudes.

Concerning education level as a variable that impacts sustainable consumption, it appears that higher educational-level individuals have deeper environmental concerns (Van Liere and Dunlap, 1980; Jones and Dunlap, 1992; Raffay-Danyi and Formadi, 2022; Sox *et al.*, 2013).

The review of the relevant literature demonstrated that more research is needed on the relationship between sociodemographic variables and attitudes, especially on the influence of gender, age and education level on attitudes towards sustainability. There is a lack of studies on the impact of sociodemographic variables on attitudes towards academic conferences' sustainability. This study intends to contribute to filling this gap.

3. Research model

According to the Theory of Reasoned Action and Theory of Planned Behaviour, attitudes are dispositions to respond to attitude objects, i.e. situations or events that activate them and predict behaviour (Ajzen, 2005). Both theories assume that people rationally or spontaneously engage in a particular behaviour based on beliefs from various sources, such as experience, education, mass media or interactions with family and friends regarding the behaviour in question (Fishbein and Ajzen, 2010). People's beliefs about the positive or negative outcomes of performing that behaviour determine their attitudes towards personally engaging in the behaviour (Ajzen and Fishbein, 1980). According to the Theory of Planned Behaviour, behavioural intentions are informed by attitudes, subjective norms and perceived behavioural control. Attitudes, specifically, are directly informed by behavioural beliefs, while subjective norms and perceived behavioural control are informed by normative beliefs and control beliefs (Fishbein and Ajzen, 2010).

The theories of Reasoned Action and Planned Behaviour's tenets can be combined into a useful theoretical framework for attitudes and behavioural intention towards sustainable events. These approaches suggest that people with favourable attitudes towards sustainability and a strong behavioural intention to engage in specific sustainable behaviours related to sustainable events will be more likely to join in these behaviours. Also, that psychological factors (i.e. social influence, habit formation, feelings and cognition) can favour the adoption of sustainable behaviours (Klaniecki *et al.*, 2019; White *et al.*, 2019). Conversely, the likelihood that individuals will engage in these events will decrease when they have less favourable attitudes and weaker behavioural intentions.

Based on theories of Reasoned Action and Planned Behaviour, the present research focused on academic event attendees' attitudes because measuring attitudes is a means of predicting behaviours (Ajzen, 2005). People with favourable attitudes towards sustainable event practices are more likely to engage in sustainable behaviours. Five sets of sustainable practices in events have been identified in the literature and included in the present study's proposed model through variables that measure attitudes towards clusters of sustainable

practices related to (1) transportation, (2) event venues, (3) catering, (4) materials and (5) accommodations.

Academic event attendees' demographic variables were further incorporated into the research model as control variables since previous studies have shown that individuals' experience, education and interactions with family and friends are antecedents of attitudes (Fishbein and Ajzen, 2010). The attendees' gender was expected to be a significant variable that explains different intensities of attitudes towards sustainable academic events. Efforts to make consumption more sustainable influence individuals' attitudes differently depending on gender (Bloodhart and Swim, 2020). In addition, the proposed model posited that older attendees would have more favourable attitudes regarding the events' sustainability than younger individuals due to the broader worldview (Fermani *et al.*, 2016; Roberts, 1996) and higher education levels of older participants of academic conferences.

Similarly, the current research model anticipated that attendees living in more developed geographical areas would adopt more positive attitudes towards sustainability. Prior research has found that environmental awareness is not the same in all geographic regions of the world and that a direct relationship exists between more developed world areas and greater sustainability awareness (Park *et al.*, 2012). Finally, the proposed model considered the field of research of those attending academic events because education has been found to be an antecedent of attitudes in previous studies (Fishbein and Ajzen, 2010). Figure 1 presents the research model used in the present study, and the next section details the methodology applied.

4. Methods

4.1 Survey instrument and validation

Data on attitudes towards sustainable practices that contribute to transforming academic conferences into more sustainable events were collected with a questionnaire based on the above literature review using LimeSurvey's professional version. The first section assessed to what extent respondents agreed with statements related to transport to the event. The second section focused on the event venues, the third section on catering, the fourth on conference materials and the fifth on events' accommodations. Table 1 presents the main questions.

The last part of the questionnaire dealt with the respondents' sociodemographic characteristics, such as gender (Female and Male); age (≤30 years, >30 ≤ 50 years, > 50 years); geographical area of residence (Europe, Americas, Asia/Pacific, Africa and

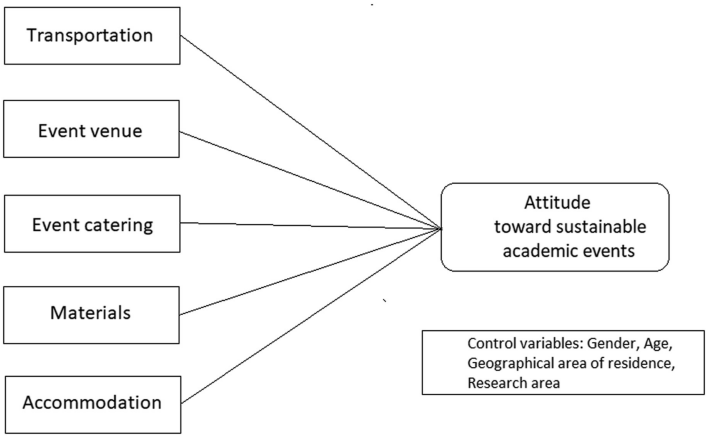

Figure 1.
Research model

Construct	Item	Indicator
Transport	*To what extent do you agree with the following statements? (1 = Do not agree at all; 5 = Completely agree)*	TR1
	I prefer to use public transport (e.g. train) to travel to the event site (Myung, 2018)	
	I am willing to share my car with other participants to travel to the conference (Collins and Cooper, 2017)	TR2
	Carpooling (i.e. sharing a car) among participants should be encouraged by the event organisers (Collins and Cooper, 2017)	TR3
Event venues	*To what extent do you agree with the following statements? (1 = Do not agree at all; 5 = Completely agree)*	VN2
	I expect the event venue to have environmental certification	
	I prefer venues with appropriate recycling and environmentally friendly waste management systems (UNEP, 2009)	VN3
	The conference venue should have recycling bins in all public areas for the different types of recyclable waste, such as plastic, metal, glass or paper, with each assigned different colours. (Hottle *et al.*, 2015)	VN4
	Event venues can play a crucial role in the participants' environmental education (Hottle *et al.*, 2015; Laing and Frost, 2010)	VN5
	I am willing to pay more for a conference held in a sustainable venue (Myung, 2018)	VN6
Catering	*To what extent do you agree with the following statements? (1 = Do not agree at all; 5 = Completely agree)*	CT1
	I prefer local fresh food products in the conference meals and coffee-breaks (Santos *et al.*, 2020b)	
	When using food of animal origin, the event should ensure that food is produced to high animal welfare and environmental standards (Boggia *et al.*, 2018; UNEP, 2009)	CT2
	Event catering should also include organic and vegetarian menu options (Boggia *et al.*, 2018; Neugebauer *et al.*, 2020)	CT3
Materials	*How important are the following aspects to you when choosing your next conference? (1 = Not important at all; 5 = Very important)*	CF1
	Signage, badge holders and other materials should be reused at the next event (Neugebauer *et al.*, 2020; UNEP, 2009)	
	When printing is unavoidable, recycled paper and double-sided printing should be used (UNEP, 2009)	CF2
	Participant bags and/or packs, banners, gifts and other relevant items are produced using organic or recycled material (UNEP, 2009)	CF3
Accommodations	*How important are the following aspects to you when choosing accommodations for the conference? (1 = Not important at all; 5 = Very important)*	AC1
	Environmental certification (UNEP, 2009)	
	Environmentally friendly cleaning practices (UNEP, 2009)	AC2
	Information about sustainable practices on the accommodations' website (Santos *et al.*, 2019)	AC3
	Water-saving devices (Santos *et al.*, 2019)	AC4
	Energy-efficient devices (Santos *et al.*, 2019)	AC5

Table 1.
Questionnaire

Middle East); and research field (Arts, Humanities and Law, Engineering and Architecture, Formal, Natural and Life Sciences, Management, Social Sciences and Tourism). This section included a qualifying question in the form of an open-ended question on the number of academic conferences attended over the previous five years.

Table 2 presents the questionnaire's convergent validity and reliability. The variables Transport, Venues, Catering, Materials and Accommodations were measured using multiple

Attitude	Indicators	Loadings	α	AVE
Transport	TR1	0.745	0.669	0.629
	TR2	0.867		
	TR3	0.865		
Venues	VN2	0.731	0.814	0.681
	VN3	0.814		
	VN4	0.742		
	VN5	0.763		
	VN6	0.738		
Catering	CT1	0.775	0.730	0.582
	CT2	0.827		
	CT3	0.815		
Materials	CF1	0.835	0.820	0.674
	CF2	0.850		
	CF3	0.878		
Accommodations	AC1	0.896	0.948	0.581
	AC2	0.922		
	AC3	0.900		
	AC4	0.925		
	AC5	0.908		

Note(s): α = Cronbach's alpha; AVE = average variance extracted

Table 2.
Measures' convergent validity and reliability

indicators, and their reliability and validity were evaluated using Cronbach's alpha and average variance extracted (Henseler, 2017).

4.2 Sample

The study population comprises researchers who published their findings in Scopus-indexed journals in 2020, 2019 and 2018 and have participated in academic conferences in the previous five years before 2020. In the Scopus database, there were 27 subject areas representing 298 subject categories. The subject categories were then codified using an Excel spreadsheet, and 10 were randomly chosen (Arts and Humanities, Law, Engineering, Architecture, Mathematics, Physics and Astronomy, Medicine, Anatomy, Business Management and Accounting, Social Sciences, and Tourism Leisure and Hospitality Management) using a random selection generator. Out of each of the 10 subject categories, 10 journals were chosen (the first 4 from the first quartile, the first 3 from the second quartile, the first two from the third quartile and the first one from the fourth quartile). From each journal, 35 authors' email addresses were taken by clicking randomly on journal issues from 2020, 2019 and 2018. Following Scimago/Scopus journal rank indicator of measuring the impact of publications in the three previous years, we opted for the period mentioned above, an indicator that the probability that these researchers were still active was high.

A total of 3,500 emails were sent to authors of papers published in 2020, 2019 and 2018, asking these researchers to answer the questionnaire, and an initial number of 720 responses was collected. All incomplete questionnaires were discarded. Also, only scholars that had attended more than two conferences in the five previous years qualified for the study, leaving 532 valid questionnaires from authors across different research fields and from 68 countries on four continents. The data were subjected to descriptive analysis using SPSS. The sample's sociodemographic characteristics are presented in Table 3.

Most respondents are male (56.0%), and they belong to the 30–50 years old age group (57.4%), have a PhD (82.5%) and live in Europe (53.0%). This study used the world areas proposed by the United Nations: Europe, the Americas, Africa, the Middle East, and Asia and

Characteristics	%
Gender	
Male	56.0
Female	40.0
No answer	4.0
Age	
≤30	12.3
>30 ≤ 50	57.4
>50	30.3
Education	
Bachelor's	2.1
Master's	13.9
PhD	82.5
Geographical area of residence	
Europe	53.0
Americas	25.9
Asia and Pacific	13.0
Africa and Middle East	8.1
Professional status	
Professor/Lecturer	71.8
Researcher	32.0
Industry	2.8
PhD student	11.1
Master's student	1.9
Research area	
Arts, humanities and law	7.9
Engineering and architecture	9.9
Formal, natural and life sciences	18.7
Management	25.3
Social sciences	17.9
Tourism	20.3

Table 3. Sample's demographic characteristics

the Pacific. Data for Africa and the Middle East were grouped because data for these two world regions were scarce. Regarding professional status, answers were given on a multiple-response scale, showing that a large majority were lecturers and/or professors (71.8%) and/or researchers (32.0%) or PhD students (11.1%). On a similar multiple-response scale, most respondents indicated that their field of research was management (25.3%), tourism (20.3%), formal, natural, and life sciences (18.7%), or social sciences (17.9%).

4.3 Data analysis

This study applied two types of techniques to conduct the data analysis: statistical and computational. The former consisted of parametric and non-parametric tests to determine the demographic variables' significance in attitudes towards sustainable academic events. The latter relied on an artificial neural network (ANN) technique applied in post-estimation analysis to ensure the robustness of the results.

The multivariate analysis's different assumptions were evaluated statistically. The normality assumption was examined using the Kolmogorov–Smirnov test, and its results indicated that the constructs are not normally distributed. Thus, the various groups within the sample were compared using the Mann–Whitney U test and Kruskal–Wallis H test,

which are non-parametric methods to determine whether a group of data comes from the same population. To calculate the U statistic, each of the values of the two samples is assigned its range to construct equation (1), where n_1 and n_2 are the respective sizes of each sample, and R_1 and R_2 are the sums of the ranks of the observations of samples 1 and 2, respectively. The U statistic is defined as the minimum of U_1 and U_2.

$$U_1 = n_1 n_2 + \frac{n_1 (n_1 + 1)}{2} - R_1 \text{ and } U_2 = n_1 n_2 + \frac{n_2 (n_2 + 1)}{2} - R_2 \quad (1)$$

For its part, the H statistic was calculated for k groups – each with N observations using Equation (2):

$$H = \frac{12}{N(N+1)} \sum_{i=1}^{k} \frac{R_i^2}{n_i} - 3(N+1) \quad (2)$$

in which R_i is each group's rank.

The ANN technique used was the multilayer perceptron (M.L.P.), a computing method made up of processing units called "neurons" that function similarly to the human brain in terms of learning and storing knowledge. ANN has been successfully applied in studies of tourism (Fernández-Gámez *et al.*, 2016; Siroosi *et al.*, 2020) and consumer behaviour (Sakar *et al.*, 2019), in which this technique outperformed traditional statistical techniques in terms of precision (Chong, 2013).

M.L.P. is a class of ANN composed of input and output layers and a hidden layer related to the previous two but without any connection to the outside. The input data are sent to the output layer through the hidden layer using a trigger function or backpropagation algorithm. This algorithm adjusts the synaptic weights to minimise errors, measured by the difference between the actual and desired output.

When a set of pairs of learning patterns $\{(x_1, y_1), (x_2, y_2) \ldots (x_p, y_p)\}$ and an error function $\varepsilon(W, X, Y)$ are presented, the process training comprises a search for the set of weights that minimises the learning error $E(W)$ based on Equation (3):

$$\min_W E(W) = \min_W \sum_{i=1}^{p} \varepsilon(W, x_i, y_i) \quad (3)$$

In the present study, the M.L.P. architecture developed was built by applying the hyperbolic tangent activation function to the hidden layer and calculating the number of neurons in this layer based on the Bayesian information criterion. The M.L.P. model generated appears in Figure 2.

In addition, each independent variable's normalised importance (N.I.) was calculated using sensitivity analysis, which facilitated the determination of each variable's individual significance in terms of the issue under study (Sobol, 1990). The sensitivity analysis started with the total data and divided this dataset into groups. Each group was included in the ANN as many times as needed to reflect the model variables present. As soon as the value of one of the variables changed, a value of zero was assigned to that variable. This step can be done by evaluating participants' responses based on already-known ranking values. The calculation is expressed as Equation (4):

$$Sx_i = \sum_{j=1}^{n} \left(\Phi x_{ij}(0) - \Phi x_{ij}\right)^2 \quad (4)$$

in which $\Phi x_{ij}(0)$ is the value of the ANN's output when variable X_i is zero, Φx_{ij} is the known classification value, X_i is the significant variable and Sx_i is each variable's sensitivity analysis result.

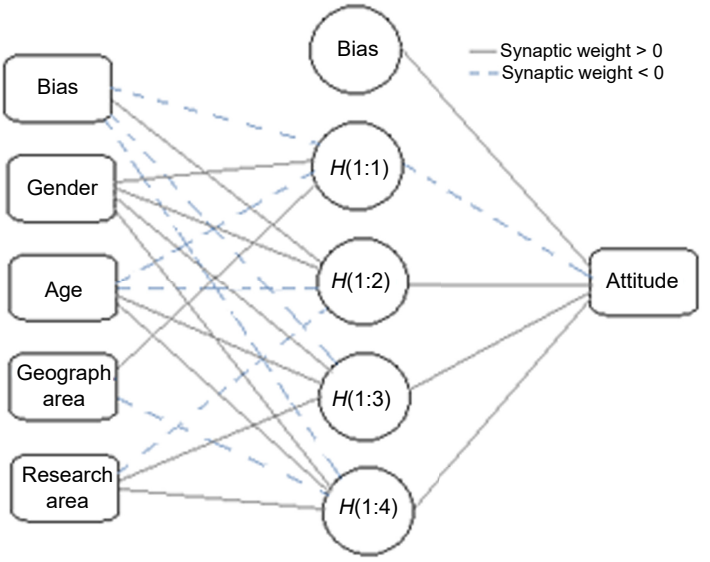

Figure 2.
MLP architecture

5. Results

5.1 Non-parametric test

The results for the relationship between attitudes and gender appear in Table 4. The Mann–Whitney test indicated that significant differences appear according to the respondents' gender and that these variations exist in all the attendees' attitudes towards sustainable events. Women present a stronger attitude towards venues, catering and materials than men do ($p < 0.01$). Concurrently, women's mean and median values for attitudes towards transport and accommodations are higher than men's ($p < 0.05$).

The results for age's connection to attitudes towards sustainable events appear in Table 5. In this analysis, the sample was divided into age groups: up to 30 years old, between 30 and 50 years old and more than 50 years old. The results confirm that attitudes differed according to age group and were verified for each of the attitude constructs ($p < 0$ 0.05).

The age group with the highest mean and median values is respondents between 30 and 50 years old. The next highest attitude scores belong to the group over 50 years old. Finally, the group under 30 years old presents the lowest values. The differences found between age groups thus indicate that attendees who are 30 years old or older have more favourable attitudes towards sustainable events.

Table 4.
Gender's effect on attitudes

	Male			Female			
Attitude	Mean	Median	SD	Mean	Median	SD	M-W test
Transport	3.873	4.000	0.945	4.064	4.333	0.913	0.015*
Venues	3.721	3.800	0.885	4.047	4.200	0.708	0.000**
Catering	4.139	4.333	0.825	4.510	4.666	0.639	0.000**
Materials	4.222	4.333	0.869	4.611	4.739	0.616	0.000**
Accommodations	3.492	3.600	1.033	3.654	4.000	1.052	0.033*

Note(s): M-W = Mann–Whitney test; SD = standard deviation; **$p < 0$ 0.01; *$p < 0$ 0.05

Regarding the geographical area of residence's effects, Table 6 lists the results, which confirm some significant differences associated with the four areas considered in the present study: Europe, the Americas, Asia/Pacific and Africa and the Middle East. Variations appear concerning the conference materials and accommodations constructs ($p < 0.05$). Conference materials' highest mean and median values belong to Europe (4.432 and 4.666, respectively) and the lowest to Africa and the Middle East (4.096 and 4.333). Attitudes towards accommodations for attendees from Asia/Pacific have the highest average and median values (3.857 and 4.010, respectively), but respondents from the Americas present the lowest values (3.388 and 3.600).

Finally, the results in Table 7 indicate no significant differences in attitudes towards sustainable events according to the six broad fields of research considered: arts, humanities and law; engineering and architecture; formal, natural and life sciences; management; social sciences; and tourism. The null hypothesis of equality between groups was supported for all attitude constructs ($p > 0.05$).

5.2 ANN validation

The M.L.P. model's predictive power was evaluated using the root mean square error (RMSE) and mean absolute percentage error (MAPE). The results shown in Table 8 indicate a 98.457% fit with the training data, 97.279% with the validation data and 96.065% with the testing data. The RMSE and MAPE levels are also adequate.

In addition, sensitivity analysis was conducted to compare the independent variables' relative importance and N.I. The results in Figure 3 reveal that the N.I. ranges from 16.9% to 100%, highlighting gender as the strongest predictor of attitudes towards sustainable events (N.I. = 100%). The variable of age comes in second (N.I. = 77%). The other variables analysed all have an N.I. that does not exceed 20%. These results thus indicate that the variables with the greatest weight in explaining the strength of the respondents' attitudes are gender and age. The variables related to the field of research and geographical area are, in contrast, of little importance in clarifying the issue under study.

	≤30 years			>30 ≤ 50 years			>50 years			K–W
Attitude	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	test
Transport	3.779	3.833	0.825	3.986	4.000	0.817	3.779	3.799	0.868	0.045*
Venues	3.627	3.800	0.865	3.945	4.000	0.766	3.754	4.000	0.922	0.010*
Catering	4.215	4.666	0.846	4.395	4.666	0.675	4.105	4.333	0.900	0.006**
Materials	4.110	4.333	0.910	4.454	4.666	0.707	4.333	4.666	0.891	0.009**
Accommodations	3.255	3.400	1.064	3.639	3.800	0.998	3.470	3.600	1.118	0.030*

Note(s): K–W = Kruskal–Wallis test; SD = standard deviation; **$p < 0.01$; *$p < 0.05$

Table 5. Age's effect on attitudes

	Europe			Americas			Asia/Pacific			Africa and Middle East			K–W
Attitude	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	test
Transport	3.978	4.000	0.949	3.934	4.000	0.890	4.026	4.333	0.934	3.709	3.666	0.949	0.216
Venues	3.833	4.000	0.866	3.826	4.000	0.804	3.955	4.200	0.785	3.836	4.000	0.823	0.723
Catering	4.302	4.666	0.793	4.212	4.333	0.796	4.391	4.333	0.711	4.232	4.333	0.768	0.352
Materials	4.432	4.666	0.805	4.343	4.666	0.803	4.3814	4.666	0.773	4.096	4.333	0.758	0.005**
Accommodations	3.509	3.600	1.055	3.388	3.600	1.050	3.857	4.000	0.930	3.702	4.000	1.052	0.010*

Note(s): K–W = Kruskal–Wallis test; SD = standard deviation; **$p < 0.01$; *$p < 0.05$

Table 6. Geographical area's effect on attitudes

Table 7.
Research area's effect on attitudes

Attitude	Arts, humanities and law			Engineering and architecture			Formal, natural and life sciences			Management			Social sciences			Tourism			K–W
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	test (*)
Transport	4.063	4.287	1.028	3.691	3.666	0.976	4.034	4.333	0.929	4.153	4.232	0.794	3.869	4.000	0.902	4.180	4.424	0.798	0.174
Venues	3.932	4.000	0.687	3.590	3.800	0.928	3.895	4.200	0.934	3.866	4.000	0.771	3.871	4.000	0.874	3.890	4.000	0.792	0.289
Catering	4.521	4.630	0.558	4.066	4.166	0.777	4.287	4.333	0.847	4.361	4.666	0.792	4.249	4.666	0.728	4.375	4.666	0.799	0.075
Materials	4.661	4.679	0.532	4.200	4.333	1.039	4.375	4.666	0.851	4.310	4.666	0.789	4.317	4.666	0.799	4.348	4.666	0.792	0.146
Accommodations	3.689	4.000	0.972	3.455	3.500	1.067	3.409	3.600	1.102	3.689	3.600	0.678	3.582	3.800	1.086	3.701	3.600	0.713	0.733

Note(s): K–W = Kruskal–Wallis; (*) Similar results are obtained using the Friedman test; SD = standard deviation

6. Discussion

Most of the above results are novel contributions to the literature as this research is among the first comprehensive investigations of the demand for sustainable academic conferences.

However, some results are comparable to previous studies findings in the broader context of events. For instance, the present results align with Mair and Laing's (2013) findings regarding recycling materials since both studies confirmed this variable is important to forming attitudes towards sustainable academic conferences. The current results also confirm that sustainable transport practices are the least significant variable in terms of forming these attitudes, which is similar to that reported by Mair and Laing (2013). The cited authors found that sustainable transport practices, such as "taking public transport, walking, cycling and using a carpool", are attendees' least valued event sustainability features (Mair and Laing, 2013, p. 1119).

In line with Rittichainuwat and Mair's (2012) results, the present study verified that respondents have very positive attitudes towards sustainable venues, catering, accommodations and conference materials.

Bloodhart and Swim (2020) and Park *et al.* (2012) report that sociodemographic variables play a special role in people's attitudes and behaviours towards sustainability. The present results indicate that only some sociodemographic variables can significantly explain participants' attitudes towards sustainable academic conferences. Gender and age are important, but the geographical area of residence and the field of research are not. Given the absence of studies analysing the role of sociodemographic variables on attitudes towards

	Accuracy (%)	RMSE	MAPE
Training	98.457	0.649	0.282
Validation	97.279	0.713	0.339
Testing	96.065	0.768	0.402

Table 8.
MLP evaluation

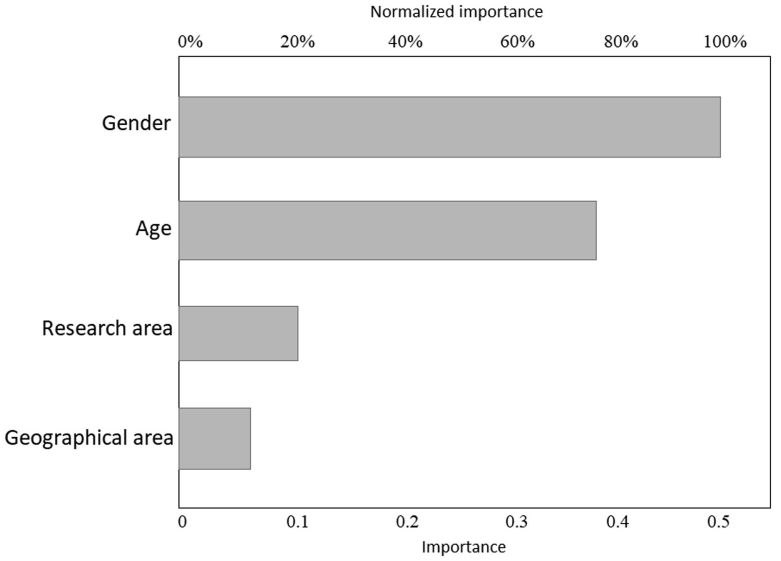

Figure 3.
Sensibility analysis

sustainable academic events, our findings may only be compared with studies on environmental awareness or attitudes towards sustainability in other contexts. Regarding gender, these findings are similar to those offered by Bloodhart and Swim (2020), Kawgan-Kagan (2020) and Zelezny *et al.* (2000). They confirmed that women present more favourable attitudes towards sustainability than men do. Concerning age, our findings are in line with those Raffay-Danyi and Formadi (2022), Bloodhart and Swim (2020), Kawgan-Kagan (2020) and Zelezny *et al.* (2000), who found that older people present more favourable attitudes regarding sustainability than younger adults.

In turn, Davies *et al.* (2019) and Song *et al.* (2012) highlight the importance of attendees' environmental awareness in their decision to participate in sustainable events. Following previous findings that a direct relationship exists between more developed world areas and greater sustainability awareness (Park *et al.*, 2012), the current research model anticipated that attendees living in more developed world areas would tend to adopt more positive attitudes towards event sustainability. Still, the results do not support this hypothesis. To understand the relevance of this finding, one should remember that the sample studied consists of highly educated individuals who publish in international academic journals, regularly travel to conferences and, therefore, tend to have a broader worldview. This finding may suggest that environmental awareness is globally spread among scholars independently of their research interests and geographical area of residence.

7. Conclusions and implications

The present study developed an analytical model of participants' attitudes towards sustainable conferences. More specifically, the model proposed that, according to the theories of Reasoned Action and Planned Behaviour, specific conference characteristics are regarded as attitude objects of the target audience, and that demographic factors such as gender, age, place of residence and research field would influence attendees' attitudes towards these attitude objects related to events' sustainability.

This study's objective was to determine whether significant differences in attitudes towards transforming conferences into more sustainable events are associated with sociodemographic variables. The findings demonstrate that some of the target audience's sociodemographic variables explain differences in attitudes. Women have stronger attitudes towards this transformation compared to men. In addition, when the attendees are 30 years old or older, they have more positive attitudes towards academic conferences' sustainability. In contrast, no significant effects were detected linked to the target audience's field of research. These results suggest that attendees' gender and age may be decisive factors for implementing sustainable academic conferences. On the other hand, sustainability is a global phenomenon already widely promoted by researchers worldwide, independent of their research field and geographical area of residence.

Results also showed that the target audience of academic conferences has strong positive attitudes towards conference sustainability, with most mean and median values around 4.0, as evidenced in the results section. According to the theories that support this research, positive attitudes are clear predictors of behaviour if the conditions that led to those attitudes are met. Strongly favourable opinions among the target audience about the attitude object (i.e. sustainable academic conferences) are a good indicator and pre-condition of participation in these events.

7.1 Theoretical implications

To our best knowledge, this research is the first to approach the sustainable transformation of academic conferences from the demand perspective. It adds to the literature by

demonstrating which sociodemographic variables significantly affect attitudes towards sustainable events.

Concerning methods, this study presented innovative solutions: the technique used for sample selection allowed to collect a sample of academic conferences' target audience covering different research fields and geographical areas; a new research model for the study of attitudes towards sustainable academic events is presented based on the Theory of Planned Behaviour and the Theory of Reasoned Action. In this sense, we hope this model will help researchers conceptualise different factors that influence the attitude towards sustainable business events and promote further research in this essential field.

7.2 Practical implications

This research allows a better understanding of attendees' attitudes towards sustainable practices of academic conferences. Following the basic marketing principle that a product should meet the desires and expectations of its customers to guarantee success, organisers of academic conferences should understand attendees' attitudes to guarantee that the product offered meets the customers' expectations.

Specific sociodemographic variables' effects on attitudes towards sustainable academic conferences can indicate how organisers can best promote these events according to attendees' characteristics. The above findings can be implemented as design strategies by academic conference planners to address the different groups that attend. Sustainable conferences can be offered to all research areas because their target audiences show a similar preparedness for accepting sustainable events.

By developing differentiated marketing campaigns, these events could further exploit some groups of potential attendees' greater predisposition to focus on sustainability issues related to academic conferences. For women and participants who are 30 years old or older, event sustainability should be emphasised as a competitive strategy for promoting and attracting these audiences. Marketing strategies for younger attendees (under 30 years old) could focus on technology, networking or attractive social programmes.

In addition, event characteristics can include more sustainable venues, catering, conference materials and accommodations, which are easier to promote, as the target audience shows strong positive attitudes regarding sustainable practices related to these items. However, the target audience demonstrates weaker attitudes towards sustainable means of transport, so this area requires organisers to provide information on the gains for health and the environment by using more sustainable means of transportation. The goal is to encourage participants to make more environmentally friendly decisions regarding more sustainable event transport. A strategy based on promoting the event as contributing to sustainable development could educate attendees and encourage them to develop stronger positive attitudes and better behaviours regarding sustainability. Sustainable academic conferences can educate students, organisers, service providers and delegates through their involvement in sustainable practices. On the other hand, event organisers should promote and coordinate carpooling among attendees and more sustainable means of transportation to reduce unnecessary CO_2 emissions.

7.3 Limitations and future research

This study's design had limitations that could be addressed in future research. First, the analyses focused on only aspects related to the attendees' attitudes. Future studies could explore in what measure positive attitudes towards conference sustainability translate into real behaviour. Second, the study's demand perspective represents just one type of stakeholder of sustainable conferences. Further research is needed on academic event organisers' attitudes and behaviours and the managers of tourism destinations where conferences are held to gain a more holistic vision.

Third, the geographical areas defined by the U.N. and used in this study have the limitation of combining highly developed and developing countries in the same geographical area, for example, the Americas and Asia/Pacific. Last, the data analysis techniques applied were limited to quantitative methods. Although they provided empirically robust results, these methods could be complemented with qualitative ones that facilitate the identification of new phenomena and a deeper understanding of the topic under study.

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