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Sustainability in Business Events: How Hybrid Formats Shape Attendee Decision-Making

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Abstract
This study explores how the availability of hybrid business event formats influences attendees' decision-making concerning sustainable practices, addressing a gap in understanding how hybrid formats impact participation choices in the context of sustainability. The research specifically aims to examine how sustainability practices in accommodation, transportation, catering, and venue selection affect the likelihood of on-site attendance and how the option of hybrid participation shifts preferences toward virtual engagement. Data was collected from 533 international business event attendees, and Partial Least Squares Structural Equation Modelling (PLS-SEM) was used for analysis. The findings reveal that hybrid events, while promoting inclusivity and reducing environmental impacts, often lead to increased online participation, particularly among attendees with strong environmental concerns. Even when sustainable practices are implemented on-site, many participants prefer virtual options to minimise their carbon footprint further. This poses a challenge for event organisers striving to balance sustainability goals with the need to maintain physical attendance to keep the business industry running. The study offers practical recommendations for organising more sustainable and inclusive events, emphasising the importance of integrating green practices while leveraging hybrid formats to meet evolving participant preferences. These insights are crucial for guiding the future of sustainable event planning in the business events industry.

Key Words: Hybrid Events; Sustainability Practices; Business Events; Attendee Decision-Making; Virtual Participation; Sustainable Event Planning; Sustainable Transformation

JEL Classification: Z310, Z320

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1. Introduction

The tourism industry has experienced substantial growth in the last decade despite the disruptions caused by the COVID-19 pandemic (Gössling et al., 2020; Üngüren & Arslan, 2022). As the world

continues to recover from the pandemic, the tourism industry is not only regaining its footing but also evolving to meet new consumer demands and preferences, driving it toward a more sustainable and resilient future (Abou-Shouk, 2023; Carlisle et al., 2023; Erul et al., 2023; Kajzar & Mura, 2023). Similarly, the global business events industry, a crucial part of the tourism sector, has also seen tremendous growth in recent decades (Toscani et al., 2024) and is now on the path to recovery (Lekgau & Tichaawa, 2023). This recovery aligns with growing awareness and urgency around environmental sustainability, with increasing pressure from consumers and policymakers for a green transformation (Kement et al., 2023; Kurniawati et al., 2022; Toscani et al., 2024; Streimikiene et al., 2022).

The integration of information and communication technologies in travel and event planning was already progressing before the pandemic (Celuch, 2021; Petkovski et al., 2022), but COVID-19 significantly accelerated the digital transformation in business and society (Antonio & Rita, 2021; Cunha & Urdan, 2023; Fernandes & Gabriel, 2023; Kliuchnikava et al., 2022; Seker et al., 2023). This shift has changed distribution and communication channels (Antón-Maraña et al., 2023; Barbosa et al., 2022; Oláh et al., 2023; Romeu et al., 2022; Štefko et al., 2023), as well as customer attitudes and behaviours (Barrantes-Aguilar et al., 2023; Fitz- Oliveira et al., 2023; de Moura et al., 2023; Sobre Fripong et al., 2023), contributing to improved environmental sustainability (Folgado-Fernández et al., 2023; Streimikiene, 2023a). A similar trend can be observed in the business events industry through a more responsible and sustainable use of resources as on-site events increasingly coexist with hybrid and online formats (Piccioni et al., 2023; Zhang et al., 2023; Koval et al., 2023; Hoang et al., 2023). Business events, especially in the on-site format, produce significant negative impacts, as they often involve extensive travel, significant resource consumption, and waste generation, making their sustainable transformation more urgent (Collins & Cooper, 2017; Dickson & Arcodia, 2018; Kozubikova et al., 2023). Santos et al. (2023a) studied how sociodemographic variables such as gender and age determine more sustainable attitudes towards green practices of on-site business events related to event catering, venue, accommodation and event materials.

In the last few years, there was a considerable number of studies exploring the emergence of virtual and hybrid meetings as a consequence of the COVID-19 pandemic in different countries, some exploring the potentialities and limitations of online and on-site conference formats (Priyatmoko et al., 2022; Lekgau & Tichaawa, 2023; Litvinova-Kulikova et al., 2023; Firmansyahrani et al., 2022). Raby and Madden (2021) concluded that attendees perceive online conferences as lacking networking and social opportunities as opposed to on-site conferences but gaining in the environmental footprint and participation costs. According to these authors, online conferences tend to have a broader audience, motivated by reduced environmental footprint and effective costs (Raby & Madden, 2021).

A few studies have explored the relationship of hybrid events with sustainability to some extent. Tao et al. (2021) made a comparative life cycle assessment, based on secondary data, of on-site, hybrid and virtual events and found that virtual events can reduce the carbon footprint by 94% and the energy use by 90% compared to on-site events. Furthermore, they assessed the environmental footprint of hybrid events and concluded that in the case of hybrid meetings with 50% online participation, event venues could reduce their carbon footprint and energy use by 60% to 70%, depending on the venue location and distances travelled. Shortening travel distance is the most critical factor for lowering the event's carbon footprint (Tao et al., 2021). Puccinelli et al. (2022) analysed a hybrid conference that took place in France in 2021 and reported that hybrid conferences have the following advantages: they offer the most flexibility to attendees for choosing the attendance mode that best suits their desire and budget compared to other conference modalities, and they reduce carbon footprint by avoiding international travel for online participants (Puccinelli et al., 2022).

Although research on event modality has made progress, there is still a gap in understanding how the format of a business event - particularly when a hybrid option is available - influences attendees' decisions to participate based on their attitudes toward events' sustainability best practices. Understanding how attendees perceive and support sustainable practices concerning the event format is crucial for the industry's future. To address this gap, this study aims to understand how the availability

of hybrid business event formats impacts attendees' decisions to participate in the face of identified sustainability best practices. Specifically, it seeks to understand how sustainable accommodations, transportation, catering, and venue choices influence on-site attendance and how the availability of hybrid options shifts preferences toward online participation.

The theory which explains the decision-making behaviour of participants in hybrid business events, especially in relation to sustainability, is the Theory of Planned Behavior (TPB) by Ajzen (1991). TPB is widely used to understand how individual attitudes, subjective norms, and perceived behavioural control influence decisions and actions. Attendees' attitudes toward sustainable practices (such as eco-friendly accommodations, transportation, and catering) and hybrid event formats influence their decision to participate on-site or online. For example, those with positive attitudes toward minimising their carbon footprint may prefer virtual participation over attending in person. Social pressures or norms, such as expectations from peers, colleagues, or society regarding sustainability, can significantly influence attendees' choices. Participants may feel compelled to align their behaviour with these expectations if it is socially expected to support sustainable practices. On the other hand, the extent to which participants feel they have control over attending an event in person or virtually is shaped by factors such as convenience, accessibility, and the environmental impact of their decision. If participants perceive that attending online is more convenient and sustainable, they are more likely to opt for the virtual format.

Ajzen (2005) argues that past behaviour strongly predicts attitudes, behavioural intentions, and actions, as behavioural tendencies tend to remain stable over time unless influenced by changing circumstances. This is precisely the case in the present study. Circumstances have shifted due to the emergence of two key factors: the availability of hybrid business events driven by disruptive technological advancements, on the one hand, and increasing sustainability pressures linked to the global climate change agenda.

Therefore, the study intends to provide new insights into how to organise more sustainable and inclusive events while keeping the business events industry running at the destinations. By doing so, the research offers insights into how event organisers can balance sustainability efforts with the need to maintain high levels of physical attendance, thereby contributing to more sustainable and effective event planning strategies.

2. Literature review

Besides discussing the sustainability implications of conference modality, the literature review also aims to identify best practices of event sustainability related to transportation, venue, catering and accommodation, which will provide the contextual framework for formulating the hypotheses.

2.1 Meeting modality and sustainability implications

The traditional business event modality is the on-site modality, which has the advantage of face-to-face interactions, networking opportunities, and the enjoyment of social and cultural programmes (Oester et al., 2017). These in-person interactions are often enhanced during coffee breaks, lunches, dinners, and other social events integral to on-site conferences (Harrison et al., 2019; Oester et al., 2017). However, this modality also presents disadvantages, including increased participation costs, long travel requirements, and a higher environmental footprint (Oester et al., 2017; Puccinelli et al., 2022).

With the development of new information and communication technologies, online and hybrid business events had already existed for at least a decade before the COVID-19 pandemic, which began in early 2020 in Western countries and severely impacted economic activities until 2022 (Al-Ababneh et al., 2022; Bartoš et al., 2023; Żemła & Szromek, 2023). During this period, due to restrictions such as social distancing, unauthorised gatherings, and closed borders, many events were cancelled or transitioned to virtual and, in some cases, hybrid modalities (Falk & Hagsten, 2021; Litvinova-Kulikova

et al., 2023). The virtual modality, in which individuals are not present in the same physical space but communicate synchronously through electronic platforms, has emerged as a significant trend (Capolupo et al., 2022; Puccinelli et al., 2022). Virtual events facilitate synchronous and asynchronous dissemination on social media platforms like Facebook, WhatsApp, and YouTube. Virtual events offer several advantages, including reducing the carbon footprint by eliminating the need for travel (Abbott, 2020; Falk & Hagsten, 2021; Skare et al., 2023) and allowing for an unlimited number of participants, which can be a limitation for physical spaces (Parncutt & Seither-Preisler, 2019; Falk & Hagsten, 2021). During the planning phase, the European Commission recommends that event organisers consider whether an on-site event is necessary or can be replaced by a fully virtual, hybrid, or multi-site event to avoid travel (European Commission, 2024).

A hybrid business event combines in-person and virtual participation, allowing attendees to join events both physically and online (Sox et al., 2017). Hybrid business events also enhance flexibility, offering diverse engagement options and increasing overall attendance (Sox et al., 2017; Mohamed, 2022). Additionally, they reduce environmental impact by lowering travel-related carbon emissions, providing a cost-effective solution that accommodates budget constraints and ensures inclusivity (Tao et al., 2021). Reporting the Greek meetings industry example, Papageorgiou and Chalkia (2022) suggest that the hybrid format will become the new standard in the post-pandemic era. According to these authors, online business meetings threaten the meeting industry and travel-related businesses, representing a major source of income and employment in many countries. Hybrid events have the advantage of providing better experiences than only online while keeping the events industry running. An advantage compared to on-site events is that they allow a larger participation than on-site events (Papageorgiou & Chalkia, 2022). Some studies assess the attendees' experience depending on the event format. Hameed et al. (2021) concluded that participants' overall experience was better in face-to-face meetings, followed by hybrid conferences, which were found to reach a broader audience and provide higher learning opportunities. Online conferences were noted for their cost-effectiveness. Another study by Rissman and Jacobs (2020) found that most academics preferred on-site conferences with small workshops, while attitudes toward the hybrid format were significantly more positive than those toward purely online formats. Puccinelli et al. (2022) assessed the preferences of 581 conference attendees (159 on-site, 422 online) regarding the preferred format for conferences, and 74% preferred hybrid meetings, while only 11% were favourable to the on-site-only format.

This study will shed light on how the availability of hybrid business events is a moderating factor influencing participants' willingness to adopt more sustainable behaviours depending on the event format.

2.2 Accommodation

Hotels and other tourist accommodations are among the most energy-intensive buildings, contributing significantly to carbon emissions due to the extensive use of air conditioning, heating, refrigeration, food preparation, cleaning, and lighting (Veiga et al., 2018). Gössling and Peeters (2015) state that tourist accommodations generate about 21% of tourism-related CO2 emissions. Accommodations must adopt innovative strategies to reduce environmental impact (Rahimizhian & Irani, 2021), enhance energy efficiency, and maintain competitiveness (Tothova et al., 2022; Kurowska-Pysz et al., 2024). Whenever possible, they should generate energy from renewable sources, such as solar power (Silva, 2022), and take advantage of incentives, like those provided by the European Union (EU), to support the implementation of these technologies (Streimikiene, 2022). Renewable energy, integral to the circular economy, contributes to sustainable development, which can only be achieved by efficiently implementing both circular economy and renewable energy practices (Jakubelskas & Skvarciany, 2023; Uddin et al., 2023; Van, 2023; Streimikis et al., 2024).

Accommodation establishments also consume large amounts of water for room use, pool maintenance, garden irrigation, laundry, and kitchen activities (Gössling, 2015). On the other hand, fresh,

clean water has become scarce in many destinations worldwide. Therefore, reusing treated wastewater prevents watercourse contamination and provides a reliable and cost-effective alternative for sanitation and garden irrigation, ensuring a steady water supply and effectively addressing issues caused by water constraints (López-Serrano et al., 2023).

In Turkey, studies have shown that proper hotel environmental management can reduce costs and increase revenue, termed "green profit" (Yenidogan et al., 2021, p. 7). However, some studies report that sustainability initiatives may lead to higher room prices, as seen in the Spanish hotel industry (García-Pozo et al., 2013) and Taiwan's green hotels (Shieh, 2012). Regarding the willingness to pay more for sustainable accommodations, some studies suggest that guests with higher financial status and higher levels of education are more likely to accept higher prices (Puciato et al., 2023; Skare et al., 2024).

Luxury amenities such as swimming pools, SPAs, and golf courses, often associated with luxury brands, do not belong to the essential accommodation services and, on the other hand, are resource-intensive and may be seen as not environmentally friendly (Serradas, 2021). Hotel location may also negatively impact the landscape and environment, especially in the case of hotels located on the seaside and other natural areas (Gelbman, 2022). Indeed, accommodations may prioritise guest experience factors such as location, luxury brand, and amenities (Oliveira et al., 2022; von Briel et al., 2022) or setting environmental sustainability before luxury amenities by centring on essential accommodation services, giving up or reducing luxury amenities while, at the same time, adopting environmental certifications, water-saving measures, and energy-efficient practices (Palani & Karatas, 2022). While making luxury accommodations more sustainable is possible, it requires trade-offs that are difficult to implement or virtually impossible to reconcile (Moscardo, 2017).

Certification often requires significant investments in energy-efficient devices, water-saving systems, and sustainable cleaning practices (Veiga et al., 2018). Hotels may also need to train staff, which involves time and resource costs, and they must cover certification fees, including application, renewal, and third-party audit costs (Fukey & Issac, 2014). While upfront costs can be high, many hotels find that long-term benefits - such as reduced utility bills, improved guest satisfaction, and appeal to eco-conscious travellers - often outweigh initial investments. The increased efficiency and enhanced brand image from certification can also lead to financial savings and revenue growth over time (Yenidogan et al., 2021).

In the planning phase, preference should be given to accommodations with effective recycling and waste management systems (UNEP, 2009). The amount of solid waste generated per room varies depending on hotel size, occupancy rate, and waste management practices (Abdulredha et al., 2018). Some studies report that a single hotel room can produce between 1.81 and 3.18 kg of solid waste daily (Abdulredha et al., 2018). Waste management effectiveness in accommodations and at the municipal level is often tied to socioeconomic development. Ginevičius (2022) states that developed countries tend to generate more waste but recycle more and send less to landfills, whereas less developed countries produce less waste, recycle less, and depend more heavily on landfills.

Therefore, incorporating sustainable practices in tourist accommodations is essential for reducing their environmental impact and offering potential long-term financial benefits. By prioritising eco-friendly solutions, the hospitality industry can contribute to global sustainability efforts and meet the growing demand for responsible tourism.

Thus, the hypotheses to be tested are as follows:

H1a: Individual well-being drivers, associated with personal enjoyment, are positively related to the intention to participate on-site.

H2a: A preference for sustainable accommodation is directly associated with the intention to participate on-site.

Considering the availability of hybrid events as a moderating factor concerning sustainability decisions, two parallel hypotheses are formulated:

H1b: The hybrid modality negatively moderates the relationship between individual well-being drivers and the intention to participate on-site, making online participation more attractive to these participants.

H2b: The hybrid modality inversely and significantly moderates the relationship between sustainable accommodation and the intention to participate on-site, reinforcing the low preference for on-site participation.

2.3 Transportation

There are tools available on the Internet for calculating transport-related carbon emissions. A calculation on the ICAO Carbon Emissions Calculator for an intercontinental single-way flight per passenger in economy class from Rio de Janeiro to Lisbon accounts for 53,306 kg of CO2 (ICAO, 2024). A recent study by Neugebauer et al. (2020) focusing on a conference attended by 800 participants confirmed that the event produced an overall impact of 455 metric tons of carbon dioxide (CO2) and that the main contributor to the conference's overall impact was transport with 388 metric tons of CO2. Transportation, particularly air travel, is the most significant contributor to the carbon footprint in the tourism industry, posing a significant threat to climate change due to its aggressive impact on the upper atmosphere (Higham et al., 2022). This is particularly relevant for events where participants rely heavily on air travel (Collins et al., 2007; Graci & Dodds, 2008). Although sustainable aviation remains a distant goal, airlines have implemented best practices to reduce their environmental footprint and enhance consumer trust by displaying their environmental commitments on their websites, showcasing efforts like carbon offset programmes, improved efficiency, sustainable fuel use, and waste reduction (Chuah et al., 2020). Studies show passengers are likelier to choose airlines that clearly communicate their environmental policies (Galhoz et al., 2024). Carbon offset programmes, which allow individuals and businesses to offset emissions by funding projects like reforestation or renewable energy, are often criticised for their lack of transparency and greenwashing and for shifting responsibility onto passengers rather than airlines (Mello, 2024).

Promoting the use of public transportation, such as trains for events, can significantly reduce the overall carbon footprint and support the economic sustainability of public transportation systems (Neugebauer et al., 2020). This also helps foster a culture of sustainability and encourages more responsible travel habits (Chirieleison et al., 2020). However, the sustainability of event-related transportation has been sparsely studied, with most research focusing on mega-events and their environmental impacts (Adema & Roehl, 2010; Dolf & Teehan, 2015).

Carpooling is another effective strategy for reducing the carbon footprint of events, particularly when actively facilitated by event organisers (Collins & Cooper, 2017; Kubera & Slusarczyk, 2023). By coordinating carpooling options and using registration data to pair attendees, organisers can reduce the number of vehicles travelling to the event, thus lowering CO2 emissions and alleviating traffic congestion (Santos et al., 2023a).

Using electric vehicles to transport keynote speakers or small groups of attendees and providing shuttle services from common arrival points to the event site can further enhance event sustainability (Collins & Cooper, 2017). Effective communication and coordination are crucial for successfully implementing these measures, ensuring that pick-up schedules align with attendees' arrival times and locations (Santos et al., 2023a).

Thus, the hypotheses to be tested are as follows:

H3a: Concerns related to transportation, particularly air travel, are positively associated with the intention to participate online.

H4a: A preference for sustainable transportation methods is positively associated with the intention to participate on-site.

Considering the hybridisation of events as a moderating factor concerning sustainability decisions, two parallel hypotheses are formulated:

H3b: The hybrid modality positively moderates the relationship between concerns related to transportation (particularly air travel) and the intention to participate online, making online participation more attractive for those concerned about the environmental impact of travel.

H4b: The hybrid modality inversely and significantly moderates the relationship between sustainable transportation methods and the intention to participate on-site, potentially reinforcing the preference for online participation even when sustainable travel options are available.

2.4 Catering

Increasing consumer awareness of environmental issues has put pressure on producers, prompting them to take greater responsibility toward their customers by prioritising practices that promote ecological balance and social responsibility (Pekersen & Canöz, 2022). A key strategy is incorporating fresh, local products into event meals and coffee breaks, which reduces the need for transportation and refrigeration (Neugebauer et al., 2020; Shankar et al., 2020). This supports local economies and lowers the carbon footprint associated with long-distance food transport (European Commission, 2024; Gallardo Vázquez, 2023; Santos et al., 2020). Additionally, selecting seasonal ingredients ensures fresher food and reduces the resources required for production, such as water and energy. However, local products are often more expensive due to smaller production scales and higher delivery costs, making it difficult to compete with large multinational suppliers who do not prioritise environmental concerns (Harrison et al., 2019; Lehtinen, 2012).

Through thoughtful menu design, the host organisation can highlight the origin and details of products, raising awareness of local offerings (Emmendoerfer, 2023; Harrison et al., 2019). Sustainable catering must also consider attendees' diverse dietary needs, including food restrictions for individual cultural values and religious or health reasons (Rodríguez-López et al., 2023). Offering options such as vegan and vegetarian meals well in advance ensures that attendees receive appropriate meals, reducing leftovers (European Union, 2024; Moretti et al., 2023; UNEP, 2009). However, leftovers of good quality should be donated to local charities, generating a positive social effect of the event and helping third-sector organisations (Martins et al., 2022), provided all food safety measures are observed (European Union, 2024).

In addition to menu planning, sustainable catering should prioritise using reusable cutlery, plates, glasses, cups, and products with minimal or no packaging. Using efficient equipment should minimise water and energy consumption (European Union, 2024; UNEP, 2009). Proper training for staff on implementing sustainable practices can lead to higher efficiency and further savings in water and energy use (Hadi et al., 2023; Jones, 2018; UNEP, 2009). Naturally, equipment must be water- and energy-efficient as a prerequisite. To reduce environmental impact, bottled water should be avoided in favour of tap water served in reusable bottles, water fountains, or refillable jugs, assuming its quality is assured (European Union, 2024; UNEP, 2009).

Waste reduction is another crucial element. Caterers can minimise food waste by accurately estimating portions and incentivising more responsible consumption (Baranowski & Kopnina, 2022). Composting organic waste and using biodegradable or reusable service ware can significantly reduce the volume of waste sent to landfills (Hottle, 2015; Oláh et al., 2022).

Thus, the hypotheses to be tested are as follows:

H5a: Sustainable catering practices, such as sourcing local organic food and reducing food waste, are positively associated with the intention to participate on-site.

H6a: The preference for sustainable catering practices, including energy-efficient equipment and minimising transportation emissions, is positively associated with the intention to participate on-site.

Considering the hybridisation of events as a moderating factor in sustainability decisions, two parallel hypotheses are formulated:

H5b: The hybrid modality positively moderates the relationship between sustainable catering practices and the intention to participate online, making online participation more attractive for those who prioritise environmental sustainability.

H6b: The hybrid modality inversely and significantly moderates the relationship between sustainable catering practices and the intention to participate on-site, potentially reinforcing the preference for online participation even when sustainable catering practices are implemented.

2.5 Venue

The choice of venue impacts not only the logistics, accessibility, and attendee experience but also significantly influences the event's environmental footprint (Nevrlý et al., 2020). A sustainable venue can reduce energy consumption, minimise waste, and promote eco-friendly practices, contributing to the overall sustainability goals of the event (Santos et al., 2023a).

Location plays a key role in the decision-making process by affecting the accessibility of a business, accommodation, or event venue (Houdement et al., 2017; Munaier et al., 2022). Since travel is the main source of CO2 emissions generated during an event, the location must be as central as possible, reducing the need for transportation to and from key arrival and departure points such as airports, train stations, and bus stations (UNEP, 2009). Choosing a venue easily accessible by public transportation can significantly reduce the carbon emissions associated with attendee travel (Mair & Laing, 2013; UNEP, 2009). Moreover, centrally located venues minimise the need for long-distance travel, further contributing to sustainability. Avoiding transportation between accommodation and the event venue is convenient for attendees and reduces emissions, achievable when the venue and accommodation are integrated or within walking distance (European Commission, 2024; Graci & Dodds, 2008; UNEP, 2009). Integrated accommodation and venue facilities enhance the attractiveness of an event site due to their ease of use (Donaldson, 2013).

The venue's commitment to sustainability is another crucial factor (Koukiasa, 2011), along with effective sustainability communication (Santos et al., 2019). Venues with certifications such as LEED or ISO 20121 demonstrate a commitment to environmentally responsible practices (Jones, 2014; UNEP, 2009). Research in the American meeting industry shows that event organisers and attendees are willing to pay more for events held in sustainable venues, especially those with environmental certification (Sox et al., 2013). These venues typically incorporate energy-efficient lighting, water-saving fixtures, and waste-reduction programs, which help lower the event's environmental impact (Draper et al., 2011; Hottle et al., 2015; Koukiasa, 2011; UNEP, 2009). Venue buildings should be designed and constructed to maximise energy efficiency by utilising daylight and minimising the need for artificial lighting and air conditioning (UNEP, 2009).

Effective recycling and waste management systems are essential for the sustainability of events. In the EU waste management policy, waste avoidance and reuse are prioritised, followed by recycling in third place, while recovery and disposal are considered the least favourable options (Streimikiene, 2023b). A study among meeting and convention planners in the USA identified recycling as the most popular and easily applicable greening measure at events (Draper et al., 2011). Recycling prevents resources from ending up in landfills and reintegrates waste into a circular economy (Krmela & Šimberová, 2023; Santos et al., 2023b; Šimková et al., 2023; Taušová et al., 2023). Stakeholders are essential in establishing and maintaining the conditions for a circular economy's successful implementation (Szczepańczyk, 2022; Mura et al. 2021; Zhidebekkyzy et al., 2023). Implementing effective waste management systems within the venue facilitates recycling and supports the reduction of overall waste generated during events (European Commission, 2024). Using colour-coded bins assigned to different waste streams (e.g., blue for paper, green for glass, yellow for plastic) streamlines the recycling process and reduces contamination, ensuring that materials are effectively recycled (Woolverton & Stevens, 2013). These bins should be strategically placed in all public areas, including conference rooms, lobbies, and dining areas, to encourage proper waste disposal (Woolverton & Stevens, 2013). Venues that integrate waste management systems into their operations often employ staff trained in sustainable practices, ensuring that waste is handled efficiently and responsibly throughout the event (Hottle et al., 2015). This enhances the effectiveness of recycling efforts and serves as an educational tool for attendees, promoting sustainable behaviours beyond the event itself (Harris & Schlenker, 2018; Hottle et al., 2015; Streimikiene et al., 2023).

Many academic events, including conferences, are often held on university campuses due to the availability of well-equipped facilities and the conducive academic environment these settings provide. The academic atmosphere fosters collaboration and intellectual exchange among participants, making campuses ideal venues for such events (Neugebauer et al., 2020). However, no study has yet evaluated the preferences of conference attendees regarding the event location, whether on campus or in a venue outside the university.

Thus, the hypotheses to be tested are as follows:

H7a: The selection of a venue with sustainable practices, including energy efficiency and waste management systems, is positively associated with the intention to participate on-site.

H8a: The proximity and accessibility of the venue to public transportation are positively associated with the intention to participate on-site.

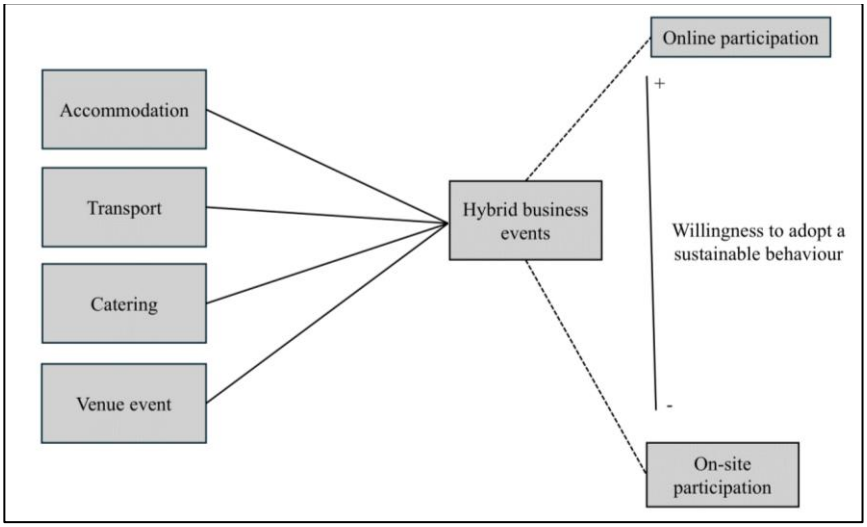
Considering the hybridisation of events as a moderating factor in sustainability decisions, two parallel hypotheses are formulated:

H7b: The hybrid modality positively moderates the relationship between the selection of a sustainable venue and the intention to participate online, making online participation more attractive even when sustainable venues are available.

H8b: The hybrid modality inversely and significantly moderates the relationship between venue accessibility to public transportation and the intention to participate on-site, potentially reinforcing the preference for online participation.

According to the presented hypotheses, Figure 1 summarises the theoretical-conceptual model of hybrid events and its effects on the willingness to adopt greener behaviour (online or on-site participation):

Figure 1. **Theoretical-conceptual model of hybrid events and willingness to adopt a green behaviour**



Source: own elaboration.

3. Methods

This study employed a comprehensive methodological approach to investigate the factors influencing conference participation in the context of sustainability. A sample of 533 participants was analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM), adhering to established

guidelines for sample size adequacy. The following sections detail the sampling process, data collection, and the analytical techniques utilised to test the proposed hypotheses.

3.1 Sampling, data collection and analysis

A survey was applied in 2020/21 to a sample of 3520 conference attendees worldwide (68 countries) who had attended two or more international conferences in the five previous years. To ensure robust statistical power in evaluating factors influencing participation in hybrid business events, we utilised G*Power to determine the minimum sample size. With a target power of 0.90, an alpha level of 0.01, and six predictors in our model, the analysis indicated a minimum sample size of 220 responses, thus supporting the adequacy of our sample to detect significant relationships in the context of sustainability practices and event participation decisions. Our sample of 533 participants substantially exceeds this threshold, ensuring our PLS-SEM analysis's statistical robustness and reliability, in line with other works with similar samples (Hong et al., 2020; Munawar et al., 2022; Park et al., 2019).

Data analysis was conducted through PLS-SEM, following Ringle et al. (2010), using SmartPLS3, favoured for exploratory studies and latent construct modelling (Hair et al., 2011; Son & Benbasat, 2007). This SEM approach, supported by PLS and prevalent in sociological research, evaluates linear causal models (Haenlein & Kaplan, 2004), allowing for visual examination of variable interrelations. The model's validity was tested using the (t) statistic at a 5% significance level (Byrne, 2001).

3.2 Questionnaire design

A questionnaire was developed based on the literature review (Sox et al., 2013; Neugebauer et al., 2020; Chirieleison et al., 2020; Collins & Cooper, 2017; UNEP, 2009; Dickson & Arcodia, 2018; Laing & Frost, 2010; Harrison et al., 2019) using the professional version of Lime Survey. The questionnaire was based on the theoretical-conceptual model presented in Figure 1, with each construct measuring the following aspects.

Regarding transportation (TP), the construct examines participants' concerns about the environmental impact of travel, particularly air travel. It evaluates how these concerns influence the intention to participate in on-site or online events, focusing on the carbon footprint associated with different modes of travel. Furthermore, the construct considers the participants' preference for sustainable transportation options and how these preferences affect their participation decisions. This construct is built upon a total of seven items.

The accommodation constructs explore participants' preferences for individual well-being drivers versus sustainable accommodation practices when attending events. It includes items that assess the influence of environmentally friendly practices, such as waste management and energy efficiency, on the decision to participate on-site. Additionally, the construct considers the individual well-being drivers related to the guest experience, such as location, price, brand, SPA, swimming pool and cleanliness. It is divided into individual well-being driver (IWBD) with seven items and sustainable accommodation (SACCOM) with five items.

In terms of venue (VEN), the construct evaluates the role of the event location in influencing participants' decisions to attend on-site. It considers the venue's commitment to sustainability, including energy efficiency and waste management systems, as well as its accessibility to public transportation. Additionally, the construct explores how these factors may encourage or deter participants from choosing on-site versus online participation. This construct is based on a total of eight items.

The catering (CAT) construct delves into the importance of sustainable catering practices, including sourcing local and organic food, minimising food waste, and using energy-efficient equipment. It assesses how these factors impact participants' willingness to attend events on-site and their perceptions of the event's overall environmental responsibility. This construct is built upon nine items.

Finally, the participation mode construct encompasses three items (On-site, Online, and Hybrid) representing different modes of event participation. It examines participants' preferences and behaviours regarding each mode. Moreover, the Hybrid item is analysed separately as a moderator to understand its influence on the relationships between other constructs and participation intentions.

All items were measured using a 5-point Likert scale, as informed by Venkatesh et al. (2012, 2022). To mitigate common method bias, as suggested by Chang et al. (2010) and Podsakoff et al. (2003), the questionnaire was meticulously designed to ensure clarity and avoid response bias while also maintaining participant confidentiality. Also, Harman's single factor test was applied, reporting 18.9% of the variance, thus confirming that common method bias posed a minimal threat to the integrity of our results, as values below 50% indicate low risk (Orgaz-Agüera & Domínguez-Valerio, 2024).

4. Results

4.1 Measurement model

Table 1 presents the psychometric properties of the model, including assessments of reliability, convergent validity, and discriminant validity. The reliability of the model structures is confirmed through the application of the Partial Least Squares (PLS) method. The reliability of each item is demonstrated by its standard loading and Cronbach's alpha values, both of which exceed the minimum threshold of 0.70. Moreover, the variables exhibit satisfactory composite reliability (CR) values, surpassing the threshold level of 0.80.

The average variance extracted (AVE) is examined to evaluate the convergent validity. The AVE values for each variable, exceeding 0.50, indicate that the model possesses convergent validity according to the established criteria (Hair et al., 2011). The VIF values ranging from 1.172 to 1.907 align with the criterion of ≤3, which indicates an acceptable level of multicollinearity within the model (Roberts & Thatcher, 2009).

Table 1. **Item loadings, construct reliability, and convergent validity**

Variable	Items	Standard loadings	Rho_A	Composite reliability	Average variance extracted (AVE)	VIF
Transport (TP)	TP1	0.869	0.850	0.772	0.723	1.907
	TP2	0.820				1.589
	TP3	0.862				1.900
	TP4	0.803				1.579
	TP5	0.872				1.602
	TP6	0.750				1.336
	TP7	0.821				1.490
Event Venue (EV)	EV1	0.799	0.793	0.704	0.628	1.475
	EV2	0.756				1.256
	EV3	0.862				1.850
	EV4	0.781				1.251
	EV5	0.852				1.455

	EV6	0.721				1.301
	EV7	0.900				1.157
	EV8	0.823				1.356
Catering (CT)	CT1	0.743	0.766	0.807	0.675	1.561
	CT2	0.853				1.472
	CT3	0.720				1.367
	CT4	0.816	0.646	0.679	0.574	1.172
	CT5	0.733				1.338
	CT6	0.817				1.634
	CT7	0.756	0.731	0.778	0.551	1.421
	CT8	0.819				1.470
	CT9	0.912				1.198
Individual well-being driver (IWBD)	IWBD1	0.802	0.772	0.726	0.640	1.418
	IWBD2	0.847				1.562
	IWBD3	0.747				1.332
	IWBD4	0.800	0.730	0.757	0.555	1.611
	IWBD5	0.837				1.686
	IWBD6	0.683				1.323
	IWBD7	0.641				1.244
Sustainable accommodation (SACCOM)	SACCOM1	0.641	0.740	0.795	0.647	1.221
	SACCOM2	0.709				1.366
	SACCOM3	0.878				1.529
	SACCOM4	0.817				1.504
	SACCOM5	0,912				1.365
Conference Modality	Online	0.641	0.920	0.890	0.720	1.221
	On-site	0.919				1.366
	Hybrid	0.811				1.529

Source: own elaboration.

Table 2 displays the discriminant validity test conducted by assessing the average variance extracted (AVE) for each construct, which yielded values surpassing the squared correlations between the focal construct and all other constructs. This disparity between the AVE values and the squared correlations provides robust evidence and affirms the distinctiveness and non-overlapping nature of the constructs under scrutiny. Thus, it confirms the presence of discriminant validity within the model.

Table 2. **Constructs correlation coefficients and the square root of AVE**

Variable	1	2	3	4	5	6	7	8	9
(1) Transport (TP)	0.851								
(2) Event Venue (EV)	0.306	0.810							
(3) Catering (CT)	0.698	0.415	0.793						
(4) Individual well-being driver (IWBD)	0.469	0.385	0.484	0.438	0.758				
(5) Sustainable accom (SACCOM)	0.419	0.283	0.344	0.404	0.536	0.742			
(6) Conference modality	0.455	0.210	0.333	0.330	0.325	0.346	0.821		

Source: own elaboration based on Fornell & Larcker (1981) discriminant validity test.

The heterotrait-monotrait (HTMT) correlations were employed to further analyse the discriminant validity. The HTMT ratio, as a crucial metric in this analysis, must not exceed 1.00, following Henseler et al. (2015) suggestions. This test concludes that all conceptual variables successfully passed the discriminant validity test, as stated in Table 3.

Table 3. **Heterotrait-Monotrait (HTMT) ratio of correlations**

Variable	1	2	3	4	5	6	7	8	9
(1) Transport (TP)	0.386								
(2) Event Venue (EV)	0.723	0.574							
(3) Catering (CT)	0.400	0.450	0.483						
(4) Individual well-being driver (IWBD)	0.515	0.406	0.443	0.552	0.811				
(5) Sustainable accom (SACCOM)	0.887	0.529	0.855	0.503	0.693	0.650			
(6) Conference modality	0.824	0.525	0.560	0.614	0.529	0.678	0.649		

Source: own elaboration.

4.2. Assessment of the structural model

The structural model was evaluated in terms of the predictive relevance of endogenous variables and the path significance. The coefficient of determination (R^2=0.633) and the Stone–Geisser's blindfolding process (Q^2= 0.623) were analysed (Ringle et al., 2010). Because both values are >0, one can conclude that the endogenous variables contained in the tested model have enough explanatory power and predictive relevancy. Table 4 presents the results of the tested hypotheses.

Table 4. **Hypothesis testing through bootstrapping analysis**

Hypothesis	Direct/Moderating Effect	Standardised Coefficient	T-Statistic	P-Value	Decision
H1a	Individual well-being drivers ➔ Intention to participate on-site	0.35	4.12	0.000	Supported
H2a	Preference for sustainable accommodation ➔ Intention to participate on-site	-0.28	3.87	0.000	Supported
H1b	Hybrid modality × Individual well-being drivers ➔ Intention to participate on-site	-0.21	2.95	0.003	Supported
H2b	Hybrid modality × Sustainable accommodation ➔ Intention to participate on-site	0.25	3.45	0.001	Supported
H3a	Concerns about transportation ➔ Intention to participate online	0.40	5.20	0.000	Supported
H4a	Preference for sustainable transportation ➔ Intention to participate on-site	0.30	3.75	0.000	Supported
H3b	Hybrid modality × Concerns about transportation ➔ Intention to participate online	0.27	3.10	0.002	Supported
H4b	Hybrid modality × Sustainable transportation ➔ Intention to participate on-site	-0.23	2.85	0.004	Supported
H5a	Sustainable catering practices ➔ Intention to participate on-site	0.32	4.00	0.000	Supported
H6a	Preference for sustainable catering ➔ Intention to participate on-site	0.31	3.92	0.000	Supported
H5b	Hybrid modality × Sustainable catering ➔ Intention to participate online	0.26	2.98	0.003	Supported
H6b	Hybrid modality × Sustainable catering ➔ Intention to participate on-site	-0.24	2.77	0.006	Supported
H7a	Selection of a sustainable venue ➔ Intention to participate on-site	0.34	4.25	0.000	Supported
H8a	Venue accessibility to public transport ➔ Intention to participate on-site	0.29	3.60	0.000	Supported

H7b	Hybrid modality × Sustainable venue selection ➔ Intention to participate online	0.28	3.18	0.002	Supported
H8b	Hybrid modality × Venue accessibility ➔ Intention to participate on-site	-0.22	2.90	0.004	Supported

Source: own elaboration.

5. Discussion

This section will analyse and discuss the hypotheses and their possible meanings and relations to the literature in the corresponding accommodation, transportation, catering, and venue subsections.

5.1 Sustainable accommodation for business events: Does it matter for event modality choice?

Regarding H1a, the positive relationship between individual well-being drivers and on-site participation suggests that participants may prioritise personal comfort and luxury over environmental considerations when attending in-person events. This finding is in line with Dolnicar and Grün (2009), Roberts and Shea (2017), and Li et al. (2023), suggesting that individuals behave differently when travelling and may prioritise their immediate convenience and enjoyment, even at the cost of increased environmental impact, leaving tourist behaviour behind when returning home. The strong coefficient in this relationship indicates that such well-being features significantly influence the decision to participate on-site, highlighting a potential challenge for event organisers aiming to promote on-site attendance while keeping a strong environmental commitment. They should offer accommodations that combine comfort and well-being amenities with environmental best practices in a way that does not compromise attendees' well-being expectations.

On the other hand, H2a suggests something contrary to what might be expected. The negative association between a preference for sustainable accommodation and on-site participation suggests that individuals might be less inclined to attend in-person events even when sustainable accommodation is offered. This could be due to the perceived inconvenience or lack of appeal in sustainable accommodations by associating them with a lack of luxury amenities.

Concerning the effects of hybrid events, H1b found a moderating effect of the hybrid modality on the relationship between individual well-being drivers and on-site participation. Thus, this hypothesis reveals that offering a hybrid event format with sustainable accommodation can shift participant preferences towards online attendance. This suggests that when given the option of participating online or on-site with sustainable accommodation, participants who appreciate the non-sustainable amenities and luxuries of the accommodation might prefer the convenience of participating online rather than compromising their on-site comfort. Also, concerning H2b, the hybrid modality's negative moderation of the relationship between sustainable accommodation and on-site participation reinforces the trend where individuals with strong environmental values may opt for online participation over on-site, even when sustainable accommodations are available. This finding implies that the hybrid format may further diminish the attractiveness of on-site events for sustainability-conscious participants.

5.2 Transportation implications: A pathway to sustainable event participation?

Concerning H3a, the study revealed that concerns about the environmental impact of air travel strongly motivate participants to choose online participation over on-site attendance. The significant positive relationship suggests that transportation-related environmental concerns are a critical factor in decision-making, reflecting growing awareness and prioritisation of reducing carbon footprint among

participants. This is one of the first studies to validate empirically this hypothesis. It confirms that attendees are aware that long air travel contributes significantly to the event's carbon footprint. Several researchers have stated that air travel has the heaviest environmental footprint in tourism and events (Higham et al., 2022; Neugebauer et al., 2020; Collins et al., 2007; Graci & Dodds, 2008) and that eliminating intercontinental flights would play a significant role in lowering carbon emissions associated with in-person conferences (Raby & Madden, 2021). Additionally, H4a suggests a positive association between a preference for sustainable transportation and on-site participation, highlighting that participants who prioritise environmentally friendly travel options are more inclined to attend events in person. In line with Neugebauer et al. (2020), Collins and Cooper (2017) and Santos et al. (2023a), this finding suggests that providing and promoting sustainable transportation options, such as public transport or carpooling, could be an effective strategy to encourage on-site attendance while aligning with participants' environmental values.

Concerning the effects of the hybrid modality, H3b suggests a positive moderation in this context. Thus, the availability of an online participation option significantly amplifies the possibility of avoiding travel, particularly air travel. For participants who are highly concerned about the environmental impact of their transportation choices, the hybrid format offers a compelling alternative, reinforcing the decision to participate online rather than on-site.

Finally, hypothesis H4b suggests that the hybrid modality might shift preferences toward online participation even when sustainable transportation options are available. The negative moderation suggests that online participation's convenience and reduced environmental impact might outweigh the benefits of sustainable on-site participation, further complicating efforts to encourage in-person attendance among environmentally conscious participants.

5.3 Sustainable catering practices and green events: where is the balance?

Concerning H5a, the positive relationship between sustainable catering practices and on-site participation suggests that participants value and are drawn to events prioritising environmental responsibility in catering. This indicates that sustainable catering can be a significant factor in promoting on-site attendance, as it aligns with participants' values and enhances the perceived environmental credibility of the event. Similarly to this relation, H6a reinforces that participants who value sustainability in catering are more likely to attend events on-site. The positive association suggests that emphasising sustainable catering practices could be a key strategy in encouraging in-person participation while meeting the environmental expectations of attendees. On the one hand, food is a key motivation for travelling since gastronomic experiences have a strong sensory appeal (Dixit & Prayag, 2022) and, on the other hand, attendees perceive a clear relationship between local products and sustainability (Lehtinen, 2012).

Concerning the effects of the hybrid modality, H5b suggests a positive moderation effect in this context, indicating that even when sustainable catering is offered on-site, participants may still prefer to participate online, particularly if they are strongly committed to minimising their environmental impact. This suggests that for some participants, the overall environmental benefits of not attending on-site (e.g., avoiding travel emissions) may outweigh the advantages of sustainable on-site catering. Additionally, H6b reveals that even with sustainable catering practices in place, the availability of an online option might lead participants to prefer online participation. This indicates that the hybrid format may challenge the effectiveness of sustainable catering as a draw for on-site participation.

5.4 Greening the event's venue

Concerning H7a, the revealed positive relationship suggests that participants are more likely to attend events on-site when the venue demonstrates strong sustainability credentials. This supports the notion that the choice of venue plays a critical role in participants' decision-making, particularly when it aligns with their environmental values. Additionally, H8a supports this, indicating that the ease of access to public transportation is a significant factor in encouraging on-site participation. The positive

relationship suggests that venues conveniently located and accessible via sustainable transportation are more likely to attract attendees. Our study is also novel in providing empirical evidence for this finding, connecting event location with the availability of sustainable transportation. On the other hand, it also confirms that event location plays a key role in the decision-making process, in line with the literature (ex., Houdement et al., 2017; Munaier et al., 2022).

Concerning H7b, a positive moderation effect was revealed, suggesting that the hybrid format can reduce the incentive to attend on-site even when the venue is sustainable. This highlights the potential challenge for event organisers in convincing participants to attend in person, even when the event is held in an environmentally responsible venue. Additionally, hypothesis H8b suggests that despite the venue's accessibility via public transport, the availability of an online option might still lead participants to prefer online participation. This finding underscores the challenge of promoting on-site attendance, even when the event is logistically convenient and environmentally sustainable.

6. Conclusions and Implications

Testing these hypotheses provided critical insights into the complex interplay between sustainability considerations, event participation modes, and the influence of hybrid modality. The analysis reveals that while sustainable practices in accommodation, transportation, catering, and venue selection positively influence participants' intentions to attend events on-site, the hybrid modality often moderates these relationships in favour of online participation. This shift suggests a potential preference for the convenience and reduced environmental impact of online participation. Furthermore, the analysis highlights the importance of considering participant behaviour and preferences in designing and promoting events. The hybrid modality's moderating role suggests that participants weigh multiple factors, including the overall environmental impact of attending, the convenience of online participation, and the sustainability credentials of the event. Therefore, strategies to enhance on-site attendance must emphasise sustainability and consider how hybrid options influence participant decisions.

Another relevant conclusion is that hybrid business events offer a balanced approach, addressing various concerns related to sustainability, accessibility, and personal convenience, thereby meeting contemporary business meeting participants' evolving needs.

6.1 Theoretical Contributions

This study makes relevant theoretical contributions to event management, especially hybrid event formats and their relations to sustainability. It extends existing research on attendee behaviour in the presence of sustainable practices of hybrid business events, namely the decision-making process concerning the attendance mode. This study claims to be the first to empirically test the decision-making process of online or on-site participation when business events' sustainable best practices are available. It advances knowledge on how technology and sustainability converge to influence participation behaviour.

6.2. Practical Implications

This study offers several practical implications for event organisers and stakeholders in the business event industry. First, it underscores the importance of integrating sustainable practices into event planning, particularly in areas like accommodation, transportation, catering, and venue selection. When adopting eco-friendly practices, organisers can encourage more participants to attend on-site, address environmental concerns and enhance the event's attractiveness.

Second, the findings suggest that offering hybrid options is essential for meeting the growing demand for flexibility, especially among participants concerned about their environmental impact or the expenses associated with long travel and accommodation costs. However, to balance this shift toward online attendance, organisers should promote sustainable on-site alternatives, such as green

transportation options and eco-friendly catering. This approach can incentivise on-site participation while maintaining the event's environmental integrity. Additionally, the study highlights the need for clear communication about sustainability efforts. If they actively promote their environmental initiatives, event organisers can align with the values of environmentally conscious attendees, strengthening their brand reputation and appeal.

Lastly, the hybrid event format provides a practical solution for accommodating diverse participation preferences while reducing the carbon footprint of large-scale events. Because the events industry generates employment for on-site events and contributes to the economy and well-being of the host region, it is desirable to keep the industry running. Our results suggest that offering different experiences for on-site attendees that are impossible to enjoy through online participation is necessary to increase on-site attendance. This involves centring the on-site experience on a high level of comfort and well-being amenities in a way that does not compromise attendees' well-being expectations. On the other hand, efforts should be made to promote networking opportunities and different experiences associated with social, cultural/musical, and gastronomic events. This means incorporating festivalisation elements into the business event to create a more engaging and immersive festival-like experience, as proposed by Jung et al. (2024).

Organisers of hybrid events can actively promote on-site participation for attendees who do not need air transportation by incentivising public transportation and carpooling among attendees. On the other hand, the communication strategy for attendees needing long-haul flights to attend on-site should be geared towards incentivising online participation. Effective tools to promote online participation in such cases are price and technology. If the attendance fee for online participation for attendees travelling long distances is substantially lower, and if online attendance allows to switch between sessions and follow the whole event, including interaction with other participants, participating online can become more attractive. This dual approach can help organisers manage costs, improve inclusivity, and position their events as environmentally friendly.

6.3 Limitations and Future Research

One limitation of this study is its focus on a specific subset of business events, which may limit the generalisability of the findings to other types of business events.

Future research should explore a broader range of business event types to determine whether the observed trends hold across different contexts. Comparative studies across regions or countries with varying levels of environmental awareness could provide valuable insights into how cultural factors influence sustainability-related decisions. Longitudinal studies may also be useful in assessing how participant behaviour changes over time as hybrid event formats evolve and environmental concerns become more pronounced.

Moreover, future research could delve deeper into the psychological and emotional factors that drive participant preferences for online versus on-site attendance. Investigating the role of social interaction, networking opportunities, and personal values around sustainability could reveal hidden motivators that are not captured in quantitative surveys.

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