Game, Set, Green

Exploring AI-Driven Fan Engagement with Sustainability at Tennis Tournament

Prof. Sveinung Jørgensen

———————————————

SUPERVISOR

Prof. Luigi Nasta

———————————————

SUPERVISOR

Prof. Paolo Boccardelli

———————————————

CO-SUPERVISOR

Maddalena Cibien 777001

———————————————

CANDIDATE

Academic Year 2024/2025

ABSTRACT

The study investigates the role of AI-Based Conversational in enhancing fan engagement with sustainability initiatives at tennis tournaments. Sport organizations are increasingly adopting green practices to reduce their environmental impact, but most of the time, there is a gap between these green practices and fans' awareness of them. In order to see if this gap can be bridged, the research explores whether the characteristics of an AI-Based Conversational Agent, specifically cognitive and emotional trust, can positively mediate the relationship between fans' perceptions of green practices and their engagement, identified by satisfaction and intention to participate.

Grounded on the literature from sustainability in tennis and sport, and AI and customer engagement, a scenario-based survey was conducted among 165 tennis fans, where they were asked to imagine attending a tennis tournament that implemented sustainable initiatives supported by a Conversational Agent (CA). Results confirm that green practices positively influence both satisfaction and intention to participate. Moreover, cognitive trust positively mediates these relationships, increasing their strength. Instead, emotional trust in a CA is partially statistically significant, presumably due to the one-time interaction and nature of the research.

The findings highlight that cognitive trust in AI-Based CAs can support sustainability engagement in sport events, while emotional trust needs to be observed in repeated contexts. The study presents practical solutions for sport organizers and contributes to the existing literature on sustainability and sport, and AI solutions in fan engagement.

TABLE OF CONTENTS

1 Introduction

Research over the past few decades has demonstrated that, as consumers become increasingly aware of sustainability issues, organizations are even more pressured to align their strategies and practices with sustainability goals.

One area where this shift is particularly evident is the sports industry, which is paying more attention and emphasizing achieving sustainable practices to reduce the ecological footprint of events (McCullough, Pfahl, & Nguyen, 2016). Sport federations and communities have taken various actions at different lengths to host more sustainable events, including energy efficiency, emissions reduction, smart stadiums, and waste minimization (Hugaerts et al., 2021).

Among different sports, tennis tournaments emerge due to their international impact and travel requirements, which have a substantial impact. As a result, tennis events can be seen as catalysts for a transformative change, where organizers put in place sustainability measures to contribute not only locally but also internationally to inspire a broader global change.

Research has shown that spectators' awareness is a valuable contribution to increasing the overall sustainability commitments, but often they are still unaware of how sustainability matters are faced by sport organizations and how they can contribute to those efforts (Hugaerts et al., 2021). One key issue is that many fans lack access to information about sustainability initiatives. The communication gap between organizers and spectators represents both a barrier and a missed opportunity for tennis and sport organizations in general to encourage more sustainable behaviors among fans. As a result, information about green initiatives at tennis tournaments is frequently limited or absent, preventing fans from participating and contributing to positive impacts.

This challenge brings to light a broader issue: while sports organizations progressively commit to sustainability practices, the communication tools, such as on-site signage or tailored campaigns via which they engage with attendees, remain unclear. This raises questions on alternative solutions to engage fans (McCullough et al., 2016; Neuhofer, Magnus, & Celuch, 2021).

In today's rapidly evolving business environment, the rise of new technologies, particularly AI-based technology, has had a disruptive impact on organizations, forcing them to adapt their business models and strategies. Nevertheless, organizations understood how to leverage these changes as a transformative force. The possibility of accelerating convergence with sustainability serves as an explicit example. A clear exemplification is represented by the possibility of boosting the convergence with sustainability. The strategic integration of AI

technologies into sustainability questions embodies a pivotal shift in how organizations address environmental challenges and communicate them to spectators. In particular, while AI-Based Conversational Agent applications are well known in several fields such as finance and retail, in the events industry, and in particular in sports venues, they are still evolving as a way to increase fans' engagement (Komiak & Benbasat, 2006; Mariani et al., 2023).

AI applications offer favorable solutions to enhance sustainability engagement through multilingual assistance, personalized answers, and real-time information (Schuetzler et al., 2020). CA's perception and contextual information abilities help fans ground real-time observations during the sports event and raise discussions on the in-question matters, offering a more responsive experience. The integration of AI with innovative solutions can transform not only how an event operates, but also how fans live it, creating a new demand also after the experience. Nevertheless, the possible application by sports organizations remains unexplored. There is still a critical gap to understand regarding how AI CAs' characteristics at sport events can be leveraged to enhance fans' engagement, specifically satisfaction and intention to participate, with green practices.

Spectators' experience involves both cognitive and emotional aspects, which need to be considered when integrating AI-Based technologies, employing a trust-centered lens. Indeed, trust is important when there is dependence between two entities (Chopra and Wallace, 2003), and it reduces the complexity of understanding, diminishing undesirable future behaviors from the trustee (Gefen et al., 2003). However, previous literature has not delved deep enough into understanding how the two aspects of trust, cognitive and emotional, can affect spectators' behaviors.

To address this gap, this study explores whether AI-Based Conversational Agents can be a promising solution to bridge the gap between green initiatives and fan engagement in tennis tournaments. Indeed, the aim of the thesis is not merely to investigate how tennis tournaments could be more sustainable, but also to examine whether Generative AI (in the form of Conversational Agents) can act as a mediator to enhance fans' engagement with green practices within tennis tournaments and, possibly, beyond.

While previous studies have already explored the role of trust in AI on consumer behavior in commercial settings (Komiak & Benbasat, 2006), this research applies it to the sport sustainability setting. Since personal emotions influence the perceived quality and satisfaction of a spectator experience, the thesis explores fans' perceptions considering both the role of cognitive trust and emotional trust toward an AI-Based Conversational Agent in enhancing fan engagement on green initiatives. The research is built on the idea that AI-Based Conversational

Agents can provide more than simple information; they can create trust-based relationships to foster behavioral changes.

Therefore, cognitive trust and emotional trust are studied as mediating mechanisms that can bridge the gap between the in-place green initiatives and tennis fans' awareness and engagement. The developed research question is: *Can an AI-Based Conversational Agent be leveraged to enhance fan engagement towards sustainability initiatives in contexts like tennis tournaments?*

Given the international visibility and environmental footprint, tennis tournaments are the ideal context for the research, which is grounded on a quantitative analysis of tennis fans' perceptions. Data were collected through a questionnaire to capture their opinions on green practices, satisfaction, behavioral intentions, and trust in an AI-Based Conversational Agent. The study goes beyond the existing literature, making contributions to the evolving strategies of sport organizations, based on sustainability and AI-trust for fans' engagement. It bridges the mentioned gap between the communication of sustainability initiatives at sports events and the lack of real-time engagement actions for fans. Moreover, from a theoretical point of view, it distinguishes the roles of cognitive and emotional trust in AI, exemplifying how these two dimensions operate differently in shaping people's engagement. Lastly, it identifies practical managerial implications by suggesting how tennis organizers can design AI touchpoints in venues or apps, such as green FAQs or personalized dashboards, to increase sustainability efforts' visibility and feasibility.

Turning to the structure of the research, the following chapter explores the empirical context on which the thesis is based. Chapter 3 reviews the existing literature on sustainability matters in the sport industry, with a focus on the tennis environment, and then the evolution of AI-Based Conversational Agents for enhancing customers' engagement, underlining the key role that AI and sport can play in tackling people's concerns. Together, these two chapters will lay a theoretical foundation for understanding key concepts, gaps, and findings. Chapter 4 displays the methodological framework of the research design, data collection, hypotheses formulation, methods and data analysis tools used. The following chapter delves into the results of the quantitative research by offering descriptive statistics and an analysis of the regression results. Chapter 6 is a discussion of the main findings and practical guidelines and suggestions for tennis organizers. Chapter 7 outlines the thesis's inherent limitations and the possible future research. The last chapter concludes with a review of the study.

2 Empirical context

As discussed above, sports organizations have improved measures to introduce sustainability in their strategies. At the same time, it can be argued that more work is needed to increase fans' engagement with these initiatives. In this chapter, I will explore the empirical context of my study, which exposes the idea on which this thesis is grounded.

My willingness is to research how tennis tournaments address sustainability, particularly in forming and implementing green strategies. According to the ATP Tour Sustainability Report, which was published in 2023 as the first Sustainability Report made by the Tennis Association, tennis organizations need to adopt a strategic approach to fight climate change. The strategy is based on three components: travel, events and partnership. Travel represents about 90% of the sport's carbon footprint and ways have been developed to track players and involve fans. The main advantage is that by reducing the travel-related emissions, the employee and fan experience improves.

The 2024 measures implemented the Carbon Tracker, the revision of the travel policy, the upgrade of the booking system and the exploration of new green incentives. LONGi is the official ATP Tour's partner for solar energy and hydrogen, promoting an innovative concept for sport based on the initiative "Plan - GET (Green, Energy, Tours)". Moreover, two other important partnerships were made with Lexus and Nilox for sustainable transport for the Tour events. Lastly, since 2023, in some Tour events, Waterdrop has supplied reusable bottles and plastic savings, with reusable and filtration systems. In line with the UN Sports for Climate Action Framework, 2022 is the baseline year from which, in 2040, the target of net zero (ATP Tour sustainability report, 2023).

Building on this analysis, in October 2024, I had the chance to deep dive into sustainability matters in a tennis tournament by visiting the Stockholm Open, an indoor ATP 250 tournament. While visiting the event, I observed whether and how organizers developed green practices. Unfortunately, they have not yet implemented sustainability practices all around, but decided to focus on specific actions, like having suppliers that use less plastic packaging, recyclable tennis balls, sustainable materials for the indoor hard courts and electric vehicles for transportation. Moreover, they developed an agenda called *"Game change 2030",* where the shared vision, the core values and the twelve guiding principles of the organization are outlined, based on the overall concept of *innovation and flexibility.*

To further my research, I investigated the integration between sustainability and strategy in the 2024 edition of the ATP Finals in Turin. The tournament had the aim to inspire the green

transition on and off court, taking into account all three ESG factors, environment, social and governance, as shown below in Figure 1. Moreover, a related framework was developed to ensure that the strategic choices would be aligned with international practices.
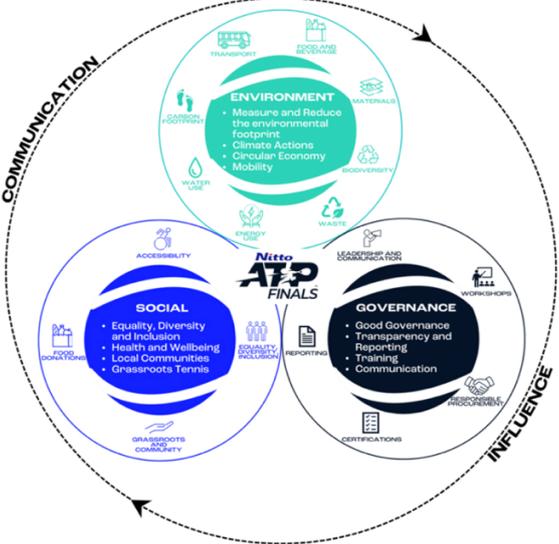

Figure 1: ESG Framework Nitto ATP Finals

In 2023, Nitto, ATP and the Italian Tennis and Padel Federation launched the Turin Green Project, which continued and improved with the 2024 edition. The Green Wall is the symbol of this innovative project, exemplifying a greening city, and is expected to reduce CO2 emissions. Also, some materials used during the event were plastic-free, such as the biodegradable napkins (from 6,000 paper napkins in 2023 to 20,000 in 2024), to give a higher sustainable experience for attendees. Dunlop's partnership increased the tournament's sustainability via a program for recycling and repurposing tennis balls for a "second life" (Dunlop & Return) and with sustainable packaging with recycled materials. The IoT was integrated into the recycling bins run on solar power with the aim of understanding when the bins are full and reducing the frequency of garbage truck pickups, making them more sustainable. The tournament vehicle fleet is provided by the electrified Lexus cars, main partner of the ATP Tour, reducing emissions and closing the gap to the 2040 target of Net Zero (Nitto ATP Finals, 2024). Overall, the Torino Green Project aimed at increasing the tournament's commitments to environmental sustainability, also giving fans the possibility to support the tournament's sustainability goals by tracking their travel emissions to and from the event (ATP, n.d.). These initiatives mark a

---

[1]Nitto ATP Finals.

significant step toward a greater spectators' involvement in green practices at sports events, but they cannot yet be considered widespread in the tennis context.

Tennis tournaments attract a lot of people and diverse audiences each year, increasing their global attention. In 2024, the Australian Open counted 1,110,657 attendees across three weeks (Australian Open, 2024), raising questions about their environmental footprint in terms of transport, food consumption, waste and energy use. They represent the ideal contexts for exploring how and whether sport organizers can blend sustainable innovation with fans' engagement. Indeed, they have a unique empirical setting for the research, considering that they have a global appeal, recurring attendance and increased pressure from stakeholders to align with sustainability standards.

Despite the visible efforts outlined above, I observed a dearth of organizers in communicating effective green strategies that engage fans in sustainability matters and practices. Therefore, it came to my mind a broader question: how can tennis tournaments better communicate their sustainability initiatives to foster spectators' engagement with them? Indeed, these efforts in place are often invisible; fans do not know what is being done, which risks rendering them pointless without proper engagement.

From this framework, and considering the disruptive effect of new technologies, I was interested in investigating the potential role of Artificial Intelligence, in the form of Conversational Agents (CAs), as a bridge for the above-mentioned gap between sustainability initiatives and fans' engagement. Even though the application of AI technologies has not been widely adopted in sports events compared to other sectors, AI-Based CAs have the opportunity to change the game into a more sustainable one, acting as mediators that positively influence fans' engagement in green practices.

As outlined and further discussed in the tennis literature below, in the tennis context, there is a scarcity of knowledge about specific sustainability efforts and, more importantly, how they can be communicated to engage fans. Therefore, the thesis is grounded on bridging this gap. The goal is to make green practices function and engage fans with them.

The following table presents a map (input, process, output, outcome, CA integration) of the recently implemented initiatives at ATP tournaments, to better understand how green practices can be operationalized and enhanced through CA integration.

Initiative (input)	Process	Output	Outcome	CA integration
Travel footprint tracker	Report of the transport modes on apps	Data on CO2 emissions	Fans' awareness of the their travel impact	Provide low-carbon travel prompt and impacts' dashboard
Sustainable transport fleet	Use of electric vehicles solutions for players and fans	Lower transport emissions	Fans' perception of organizers' green initiatives	Inform on timetables, routes and green solutions
Renewable energy partnerships	Sponsorships and programs integrated into the event operations	Renewable energy use	Fans' perception of organizers' climate committment	Show the partneships and the avoided tournament's emissions
Reusable bottles and plastics	Distribution and refill points	Reduction of single-use plastic	Fans' change of everyday habits	Give statistics on plastic savings and maps of the distribution and refill points
Recycling bins	Smart bins and waste collection monitoring	Higher recycling and lower waste	More efficient waste management and higher fans' awareness	Guide fans' recycling chioces and share bins statistics
Sustainable materials	Use of eco equipment and surfaces	Reduction of materials impact	Fans' perception of organizers' green initiatives	Explain the products life-cycle
Green catering	Adoption of eco-friendly packaging and sustainable supply chains	Reeduction of food footprint	Sustainable consumption	Highlight green food options and the related supply chains

Figure 2: Implemented green practices and CA integration

In the following chapter, I will explore the literature on sustainability and sport, AI and customer engagement in order to gain a better understanding of the concept outlined in my empirical model.

3 Literature review

3.1 Sustainability and sports events

The term *sustainability* has multiple definitions, but from a business perspective, the most relevant one is the one given in 1987 by the United Nations at the Brundtland Commission as *"meeting the needs of the present without compromising the ability of future generations to meet their own needs"* (Martin, 2024b, August 29). It was the landmark in developing awareness, but only in the last 20 years have organizations and governments started caring about the real impacts. From a holistic point of view, sustainable development refers to planetary boundaries that don't have to be exceeded to cause irreversible damage. As a management concept, instead, is balancing environmental, social and economic perspectives in decision-making processes (McCullough, B. P., & Kellison, T. B., 2017).

As global volatility and geopolitical tensions are increasing, organizations have to consider such external factors and understand how to manage complexities and prioritize their goals. Sustainability has become crucial for organizations to stay competitive in today's market. It requires organizations to change the way they create, deliver and capture value, transforming internal business divisions, appearing as an overarching strategic matter (EY Parthenon, 2022). For this reason, managers started questioning themselves about how to embed sustainability into their strategies to create value and competitive advantage while meeting stakeholders' expectations.

Matten and Moon (2008) say that the "*motives of managers, shareholders and other key stakeholders shape the way corporations are governed*", highlighting how important the structure and people that affect an organization are. Sarkar (2008) explains how, in recent years, businesses have decided to approach environmental concerns differently, leading to the transition from environmental management to environmental strategy. Gimenez Leal at al. (2003) believe that there is a positive relationship between a company's competitive position and the adaptation of environmental practices. Thorne and colleagues explain that sustainability initiatives can be communicated in both implicit and explicit ways; on one hand, implicit initiatives are focused on organizational values and industry standards, on the other hand, explicit initiatives focus on communication being part of the social responsibility of the company, increasing its reputation (Mahoney et al., 2012). Sustainability has to be integrated into organizations' corporate strategy and across all functions in a way that it is not seen as an add-on to existing functions.

The sports industry is not immune to contemporary concerns about caring for the environment. The UN specifies that *"Sport facilities, events, activities and the manufacture of sporting goods have an impact on the environment"*[2] (Mallen, C., Stevens, J., & Adams, L. J., 2011). Indeed, sport is highly impacting on the environment considering its characteristics, such as the high number of fans, travelling, consumption during the events, infrastructure and maintenance (Cayolla, R. R., Santos, T., & Quintela, J. A., 2021). Sport events are run by local organizations composed of authorities and international or national federations, and they can be both small and large scale, with international significance.

Events, by definition, are temporary, planned and themed circumstances, while in contrast, sustainability initiatives are long-lasting and resilient ways of development. For this reason, there seems to be a contradiction between these two entities due to the different time horizons, but it is only illusory: events can change people's attitude and perception on sustainability by promoting different types of experiences that increase their engagement with the overall goal. Events should be planned sustainably, besides the fact that one of the main objectives is also a post-event transition.

The image of not damaging the ecosystem and society is crucial for engaging both internal and external stakeholders during the process. There's a value behind leveraging a sustainability development strategy: leverage means planning the event strategically for achieving the desired outcomes. Therefore, if sports organizations incorporate sustainable commitments into their operational and corporate strategy, governments and national federations have to put in place standards to which they have to be aligned, recognizing the challenges of this phenomenon. They are trying to reduce the negative impact on the environment, and to overcome existing barriers, like the costs associated, that deter the adoption of green practices. Nevertheless, integrating sustainability into the sport sector is a powerful tool for implementing sustainable practices, like reducing carbon footprint through green stadiums and developing eco-friendly events to promote community engagement. Environmental concern is the key to understand if it can actually influence the decision-making process when a strategy for an event has to be planned (Sotiriadou, P., & Hill, B., 2015).

The assessment and implementation of sustainability initiatives at sporting events have grown in recent times and have been framed through the multi-dimensional sustainability frameworks, such as the Triple Bottom Line (TBL) and the Environmental, Social and Governance (ESG).

---

[2] United Nations Environment Program (2007).

The term *Triple Bottom Line (TBL)* was coined in 1994 by John Elkington, and is an approach that refers to social, environmental and economic outcomes generated by environmentally oriented business behaviors. It comes from both corporate social responsibility (CSR) and sustainable development (SD), as an expansion of the UN's 1987 environmental agenda, and it is based on three pillars (often referred to as the three Ps):

1. People (i.e., social sustainability) is an organization's positive and negative impact on society;

2. Planet (i.e., ecological sustainability) is an organization's positive and negative impact on its natural environment;

3. Profit (i.e., economic sustainability) is an organization's impact on the local, national and international economy (Zenichel et al., 2024b).

The Triple Bottom Line (TBL) approach helps the integration through an analysis of the organization's sustainability-related business behaviors under the three lenses, exploiting different types of benefits. The social component refers to the interactions between the organization and its stakeholders, and among them. In the sports sector, it is a driver for the development of events and clubs. Moreover, pro-environmental behaviors practiced by fans can yield environmental benefits not only within an event but also after it, promoting a more sustainable world. This component forms a shared TBL value, which, according to Porter and Kramer (2011), *"involves creating economic value in a way that also creates value for society by addressing its needs and challenges"*. This highlights that green strategies can increase competitive advantage while creating positive societal impacts. It helps bridge the gap between sustainability as compliance and sustainability as a strategic asset for sport organizations. Interrelated with the two other components, this approach reflects both internal benefits to the organization and external ones to society.

Complementary to this multidimensional view, the Environmental, Social and Governance (ESG) Framework offers a more standardized investment-oriented approach to sustainability (Bianchini & Rossi, 2021). It was introduced in 2006 in the UN principles of Responsible Investment, and it consists of three key dimensions on which organizations base their sustainable development:

- The Environmental pillar refers to direct and indirect tools used to address carbon emission reduction, circular economy, and energy savings;

- The Social pillar comprises actions that aim at guaranteeing customer and employee satisfaction, human rights, gender and diversity;

- The Governance pillar focuses on developing a body structure and a long-term vision, ISO standards and compliance programs.

The ESG concept can emphasize responsible management practices, playing a pivotal role in the sport business in shaping the community and the economic impacts. Moreover, it is an integral part of strategic planning and resilience, and it is part of the environmental and governance improvements (Chong, Y., 2024).

It is appropriate to examine all the environmental initiatives, considering that the social component represents the way of increasing awareness among fans and the community and the perception among sponsors. The pressure on the sports event's organizers to pay more attention to sustainability issues has increased, consequently involving all the stakeholders connected, such as sponsors, fans, local and community.

A sports venue can promote sustainability awareness indirectly by engaging with fans, but also other stakeholders, and extend it beyond the event itself. The responsibilities of an individual, from the consumer side, and of an organization, from the supply side, are two parts that can affect the overall sustainability of a sports event. Stakeholders are a fundamental resource within a sports event, since they have a key role in transforming conceptual approaches into tangible actions. (Gollagher & Fastenrath, 2023). They have to be identified and involved to have a better understanding of the actions to put into practice and how to allocate the provided resources. The meaning behind a sports event is also to bring together people, and therefore, the experience of sustainability initiatives can be fostered more exhaustively.

International organizations in recent years have developed sustainability frameworks for fostering initiatives into the different sport events agendas. In 2021, the United Nations (UN) implemented the so-called United Nations Sports for Climate Action Framework (UNFCCC) to support sports organizations and stakeholders, highlighting the central role that the sports industry has in fostering sustainability goals. It is in line with the UN Sustainable Development Goals (SDGs) of the 2015 Paris Agreement, and since then, a lot of sports organizations have invested in developing sustainable practices for contributing to a low-carbon future. The impact of a sports event is different considering its size, but organizations have acknowledged that the impact associated is relevant (travel, catering, building, energy use) (UNFCCC, 2020). To encourage the positive impact and assess sustainability, specific Key Performance Indicators (KPIs) were developed by the single organization within a sports event.

Taking into account international reporting organizations, the Global Reporting Initiative (GRI) issued in 2012 the "Event Organizers Sector Supplement" (EOSS), a summary guide for sustainability reporting for all types and sizes of events. The framework and the reporting

guidelines outline the principles that organizations can use to measure the economic, social and environmental performance. It covers the entire project life cycle of an event, from planning to the post-event. In particular, the key issues identified are associated with site selection, materials and services, managing impacts, recruiting for the event and accessibility. In this way, all the stakeholders involved can outline the activities' impact with a standardized system, for optimal decision-making and event legacy. Additionally, it provides transparency and sustainability disclosures specific to this sector, considering the increasing stakeholder expectations (GRI, n.d.).

Complementing this approach, the International Standard Organization issued for the 2021 London Olympics the ISO 20121 standard for managing event sustainability. The document specifies the requirements for sustainable event management, helping organizations integrate sustainability into event planning and strategy. The standard applies to every type of event, measuring and reducing the social, economic and environmental impacts. In April 2024, an updated version was issued that enriches the standard, putting more emphasis on inclusivity, social legacies and compliance, for a more widespread, sustainable approach to event management. It is a pivotal guideline towards ethical, eco-friendly and social practices, including all the ESG pillars, in such a way as to strengthen the stakeholder engagement and the event's reputation (ISO, n.d.).

The literature analysis shows that, in comparison to other industries, the sports sector has evolved more slowly in terms of its commitment to environmental sustainability. This lag is due to the limited engagement of sport practitioners in initiatives and commitments implemented by various organizations (McCullough, Pelcher & Trendafilova, 2020). However, there are overarching strategic approaches, called *waves*, that begin to emerge. Waves are identified by assessing common levels of environmental awareness and complexity of engagement, by assessing the actions taken by the different organizations. By identifying the various waves, a more comprehensive perspective of all the possible phases and movements in the sports sector can be assessed. The studies focusing on the innovation brought by environmental activities uncover that many actions taken by organizers impact innovation (McCullough et al., 2016).

In recent years, there has been a rapid evolution not only by sports organizers, but also by players themselves. For instance, the Austrian player Dominic Thiem actively dedicates himself to sustainability with the Sea Legacy, an organization that fights for the planet's marine ecosystem. The aim is to strive for building a better ecosystem by preserving the world's oceans.

This growing awareness highlights how sustainable initiatives among different sports sectors may create notable shifts in time and pace. Sport events have different natures and there is no one-size-fits-all solution for implementing sustainable practices; therefore, organizations need to review their operations and define what matters. Among different sectors, sustainability policies are not adopted at the same pace and determination (Trendafilova, Sylvia, et al., 2021). Indeed, each context implements unique sustainable initiatives and inter-context values, showing that there is no single way to address these matters (McCullough et al., 2016).

There are not only impacts on the environment from major international sporting events, but also from local sports activities. Nature-based sport, for example, such as skiing, impacts every day, considering the artificial snow and water use, for example, showing that all sport aspects have a link with the natural environment (McCullough, Pfahl & Nguyen, 2016). Small-scale sport events face multiple challenges, like the age of the facility, funding and human force, running into organizational barriers that can be called structural, systematic and cultural, that inhibit the possibility to implement sustainability strategies (Trendafilova, Sylvia, et al., 2021). All types of sports create complex issues and the need to analyze human behaviors, in particular event organizers, concerning the environment, considering the type of event. Organizations need to understand what is material, considering that sports events entail several decisions, like accommodation, catering, ticketing and so on. Many sports organizations highlight their goals for waste disposal, energy and transportation, reducing the cost of waste management and energy consumption, and solving the issues related to locations easily accessible with public transportation.

Despite that, they frequently do not communicate these initiatives so effectively, and tend not to increase the overall awareness, questioning the legitimacy and efficacy of these efforts (McCullough et al., 2020). Instead, they have to define a clear strategy and communicate it effectively to the stakeholders to have a substantial impact. Market forces can have a significant impact on event strategies because they are strictly connected to the concept of "greenwashing", by which organizers pretend to advance sustainable goals, while in reality they fail to deliver them in their operations. Hence, organizers are not put under pressure for the large amount of ecological damage during events and, at the same time, they can increase their reputation. Sustainability decisions need to be addressed accurately, considering that the shift towards environmental sustainability continues to grow (Trendafilova, Sylvia, et al., 2021).

Many sports organizations implement green strategies to respond not only to environmental concerns, but also to political, social and functional pressures (McCullough & Cunningham, 2010). Certainly, an aspect to be considered is integrating sustainability in the overall strategy

of an event, also by partnering with international companies to develop more sustainable solutions (Fulton, 2023). Compared to other sectors, sports organizations are linked with on-field competitors and are also appealing to third-party stakeholders (e.g., National Councils) that can assist with environmental concerns. A strategic approach is required by organizers from a variety of angles, considering the resources needed and available, planning and engagement and partnerships. Sustainability appears as a strategy that aims to improve economic and social objectives and enhance the experience lived by fans and create a closer relationship with the community. Indeed, environmental initiatives must be seen with a strategic lens rather than merely being driven by cost-saving measures (e.g., waste reduction, energy efficiencies) or revenue-generating ventures. Sport organizers need to address sustainability as any other business investment and, simultaneously, integrate an internal response of awareness (McCullough et al., 2016).

3.2 Sustainability and Tennis

Tennis is a high-profile sport, where tournaments attract a large crowd of spectators and take place all over the world throughout the year (Trendafilova, Sylvia, et al., 2021). They are long-duration events compared, for example, to the Olympics, which last only two weeks every four years (Trendafilova, Sylvia, et al., 2021). These specific characteristics make tennis tournaments a unique setting for studying sustainability initiatives. Indeed, the possibility of having environmental communications yearly offers more opportunities to share these efforts and provide incentives to implement sustainable initiatives and evaluate them (Trendafilova, Sylvia, et al., 2021).

On one side, they contribute negatively to emissions and carbon footprint, but on the other, there is the opportunity to put effort into implementing green programs and evaluating them regularly. Moreover, they take place in the same setting and different countries, providing insights into how international organizations communicate and implement sustainable efforts (Trendafilova, Sylvia, et al., 2021).

Professional tennis was created in 1913 with the birth of the International Tennis Federation (ITF), which nowadays coordinates the Grand Slam circuit (Australian Open, Wimbledon Championships, Roland Garros, U.S. Open), the professional tour for men and women and the under 18 junior circuits. In 1972, the Association Tennis Professionals (ATP) was set up to protect the players' rights and to develop professional tennis. In 1990, the ATP Tour was founded, replacing the earlier dual tennis tours Grand Prix Circuit and WCT Circuit. Later, in 2001, the ATP started including marketing and commercial activities to increase the visibility of tennis events. From 2009 to 2018, a reconstructing process occurred, when the ATP Tour changed its name to ATP World Tour and there was the introduction of new tournament categories, nowadays still present: ATP World Tour Masters 1000, ATP World Tour 500, ATP World Tour 250. After 2018, the name changed again in ATP Tour, as it is called today (ATP Tour). Throughout the years, there has been an evolution from an association to a government body and, more importantly, an implementation of strategies for making the different Tour events more structured and effective. ATP events consist of men's singles and doubles tournaments, whereas women's singles and doubles tournaments are under the Women's Tennis Association (WTA), even though some events combine both male and female competitions, like Masters 1000 in Rome, Indian Wells or Cincinnati (Sorrentini & Pianese, 2011).

Tennis events use a multitude of environmental resources in their operations and management, involving travelling, food consumption, stands, and sport equipment. Tennis organizers have

realized that environmental responsibility and economic sustainability are not independent, but rather interconnected.

International tennis tournaments, in particular the four Grand Slams, have adopted environmental measures to increase their responsibility towards this matter. The key concerns are:

1. Carbon emissions before and after the tennis event, referring to energy-intensive infrastructure, large-scale spectator and players' mobility, materials and food waste disposal.
2. Resources refer to single-use and short-life materials, disposal of end-of-life equipment;
3. Natural environment refers to outdoor management facilities;
4. Smart technologies.

In general terms, tennis events can be considered sustainable if they seek to minimize the environmental impact, but also pay attention to social and economic development. They should offer responsible use of resources not only during the event, but also create a sustainable impact in everyday habits. Moreover, from a strategic point of view, organizations that have implemented green practices have obtained competitive advantages, increasing efficiency and economic benefits at the same time.

Sustainability in tennis is increasingly seen not only as a responsibility but also as a strategic driver of economic and social value. The economic impact of green initiatives on ticket sales and fan engagement is considerable. The tennis industry has taken proactive steps to become more environmentally sustainable. For instance, in 2014, the French Open was the first French sports event to obtain the ISO 20121 certification for having met sustainability standards (Trendafilova, Sylvia, et al., 2021). Moreover, it developed a sustainability program that reduced carbon emissions while enhancing environmental awareness. In this way, the public consciousness about the relationship between sustainability and tennis has increased, strengthening fans' critical thoughts on their environmental footprints. Similarly, Wimbledon's sustainability campaign has attracted new fans, creating a community that is more environmentally aware at the tournament in supporting arranged efforts and a possible long-term relationship also outside the event itself (Trendafilova, Sylvia, et al., 2021).

Events are independent of one another, but the ATP has the role to guide and give support for a sustainable journey and experience to overcome this challenge, considering the different suppliers and sponsors involved. It sets the action planner, with priorities and targets, and the sustainable procurement into the event organizations, defining what needs to be changed. Moreover, partnerships are important to accelerate the process toward higher expertise,

innovations and global shared knowledge. Collaborating on a shared environmental and social goal strengthens the partnerships and provides a way for partners to create a more sustainable world.

There's still room for improvement, encouraging fans and players to participate in sustainable initiatives and finding new technological solutions to innovate crucial areas. The future of tennis depends on the balance between sustainable and economic goals, where sustainability is the key to maximizing the sport's longevity and stakeholders' relationships. As society becomes increasingly environmentally conscious, tennis tournaments will assume a pivotal role in pursuing sustainable development. Furthermore, tennis tournaments can serve as a model for sustainability standards in other sports events to exploit new opportunities from different types of venues and across different jurisdictions (Wang, 2025). Overall, it is not a single match; everyone is part of the ecosystem for shaping a sustainable future.

3.3 AI Conversational Agents and Customer Experience

Since the 1950s, Artificial Intelligence (AI) and derivative concepts have emerged, shaping the Fourth Industrial Revolution with disruptive technologies. Artificial Intelligence is the technology that enables computers and machines to simulate independently human learning, comprehension, problem solving, decision making, creativity and autonomy (IBM, n.d.).

In the same years, Alan Turing elaborated the idea of a chatbot as a conversational agent that could pass the Turing Test[3]. The first chatbot, known as ELIZA, was developed in 1966 by Joseph Weizenbaum, who explained that it *"makes natural language conversation with a computer possible"[4]*. Indeed, it was programmed to simulate a text-based conversation, to be indistinguishable from a human. These early basic chatbots answered questions based on predefined rule-based systems, where the bot associated the text with the keywords in the query. Factors outside the query would not be considered, with the risk of a low-quality answer.

Advances in technologies have then paved the way for Agents being able to use any unconstrained natural language inputs, making their adoption more flexible. The shift was driven by AI and the opportunity to build conversational interfaces, like chatbots, into devices or channels, allowing users to interact whenever they needed to. Just like humans, who rely on other tools to come to conclusions, AI Models can be trained to access real-time information (Wiesinger, Marlow, & Vuskovic, 2024). The introduction of Neural Networks and Deep Learning Algorithms further advanced the quality of chatbot interactions (Casheekar et al., 2024).

These developments tie directly to the concept of Agent, which stands behind the pure capabilities of AI Models (Wiesinger, Marlow, & Vuskovic, 2024). AI Agents can be defined as technologies, like chatbots or virtual agents, with which users can interact, and help imitate human interactions, having the ability to understand, stimulate or show feelings (IBM, n.d.). Compared to simple Models, whose knowledge is limited to what their training data has, AI Agents are aware of the context, they can adapt and engage with users and can act independently, using also external tools at their disposal. Operations are based on a cognitive architecture that structures reasoning, planning and decision-making, guiding also its actions (Wiesinger, Marlow, & Vuskovic, 2024). Nowadays, AI conversations are still based on linear flows, with sometimes a narrow set of responses, while tomorrow, they are going to carry out

---

[3] The Turing Test is a method for determining whether a machine is capable of thinking like a human being.
[4] Weizenbaum, 1966.

multifaceted answers, with body language, vocal modulations and other emotional prompts, becoming less tedious and confusing (Lee et al., 2020).

Conversational Agents are playing a pivotal role in contemporary literature, extending their simple role of mere digital interfaces, permeating both academic literature and real business applications. Indeed, they have already been adopted by a wide range of industries, like retail, education, hospitality, healthcare and entertainment, redefining paradigms and fostering innovation. They are widely used to engage with customers and enhance their experience by giving flexibility and convenience (Prentice, Weaven, & Wong, 2020). They can work around-the-clock, being available whenever there is a need to help and support, in multiple languages and with tailored recommendations. They are equipped with an automated routing that answers customers' queries, adding value to their experience and enhancing their satisfaction. They are designed to have natural conversations with the users (Rheu, Shin, Peng, & Huh-Yoo, 2021). In today's digital era, modern challenges and demand for personalization are becoming significant in almost every sector. Communication is instant, with just a few taps, everyone can communicate with friends, share ideas and deliver packages. Thus, many organizations have been compelled to transform their business models to align with this new concept of constant connectivity.

Organizations develop their strategy on the idea of improving the customer experience, retaining existing customers and attracting new ones. There are multiple benefits for customers while interacting with a Conversational Agent, such as a point of assistance, a communication channel of choice, an organization's document support and a way to increase the service quality. Consequently, the adoption of Conversational Agents by organizations should take into consideration two important aspects of human experience for increasing the engagement: first, user affective reactions, such as feeling comfortable, while using these technologies; and second, but not less important, the adoption of CAs needs to consider the effect on user choices and, therefore, it cannot be purely a cognitive decision (Komiak & Benbasat, 2006). For these two factors to succeed, organizations need to understand how best to introduce CAs to consumers and to what extent CAs' descriptions influence consumers' perceptions. Additionally, it is important to understand how CAs' human-like attributes influence the conversations and perceptions when using these agents (Araujo, 2018).

Sidner et al. (2005) define *engagement* as "the process by which interactors start, maintain, and end their perceived connections to each other during the interaction". Customer engagement refers to customers' contact with the organization, showing their cognitive, emotional, behavioral and social responses. Moreover, it also indicates co-creation, knowledge and
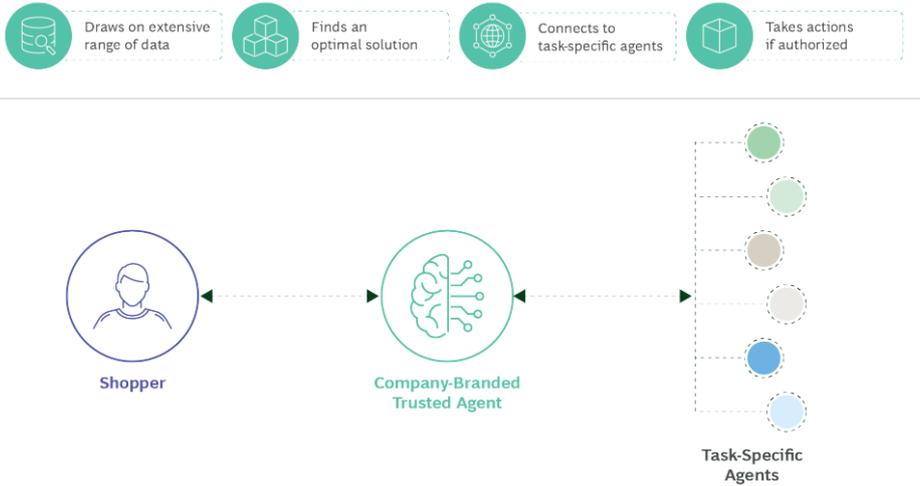
purchasing behaviors (Prentice, Weaven, & Wong, 2020). These factors result in the identification of an antecedent driver of customer engagement (Prentice & Nguyen, 2020). As demonstrated in management literature, customer satisfaction is a predictor of customer engagement. In the context of the service sector in particular, interactive experiences are significant in enhancing customer engagement. This is remarkably true when customers experience memorable moments with AI Conversational Agents that can boost the association with the brand (Prentice, Weaven, & Wong, 2020). The introduction of these new technologies in a specific sector needs to incorporate the characteristics of the industry in which these tools are adopted (Sestino et al.,2025). In the service sector, and specifically in a sports event, the exchanges between fans and CAs go beyond simple conversations, considering also aspects like non-verbal communication and emotions.

The convergence between technological forces and a better customer experience has turned into a measurable source of value creation for organizations (Mariani, Hashemi, & Wirtz, 2023). Customers play a central role in value co-creation, which is the value created by joint activities where different parties are involved in an interaction. It expresses how customer experience and, therefore, engagement can create more value. The development of modern technologies can broaden the channels for customer value co-creation by interacting with AI Agents (Gao et al., 2023). Therefore, the traditional customer journey has been explored more deeply (Mariani, Hashemi, & Wirtz, 2023). Organizations identify a positive customer experience as a competitive advantage, taking into account multiple touchpoints along the journey (pre-, during and post-consumption). Nevertheless, it is necessary to define the impact of AI Agents on customer engagement and thus value co-creation (Gao et al., 2023). The major benefits are allowing organizations to identify customer needs and expectations, enhance their experience and satisfaction, and generate market insights (Mariani, Hashemi, & Wirtz, 2023). Influencing their internal emotions, the overall engagement affects the value co-creation, enlarging loyalty and recommendations to others (Gao et al., 2023).

Before the evolution of AI- Based solutions, it was difficult to build an effective interaction between a Conversational Agent and a human being, such as through a Customer Relationship Management (CRM) platform. Today, however, Conversational AI is disrupting the B2C industry, with a convergence of platforms and soon, with behavior more like humans. It can apply to every context, and it can learn and access multiple customer touchpoints. These new integrated capabilities that enable many interactions can improve customer experience in many sectors. Moreover, the continuous evolution of Conversational Agents with AI introduction also helped with little or no machine-learning expertise in the interaction with low trials and errors.

A study conducted by Bowen and Morosan (2018) shows the capacity of AI to extract a large amount of consumer information that can be used to improve the overall experience, highlighting the importance of interactive experiences. Hence, strategically arranging AI technologies at key customer touchpoints may increase their engagement and satisfaction, leading to significant advantages for organizations (Rheu et al., 2020).

As illustrated in *Figure 3*, AI's network operates through the acquisition of users' preferences for delivering personalized experiences. Learn to converge is an imperative to keep pace with the accelerating rate of innovation. Convergence is set to occur not only between technologies but also within organizational structures, for driving a better and more efficient customer experience. Accordingly, any potential issues can be addressed at an early stage in the process (Tordjman et al., 2025).

Figure 3: How AI Agents work

These human-non-human exchanges can enhance business process redesign, producing a series of benefits like task automation, higher flexibility level, operational cost reduction and efficient customer interactions (Miklosik et al.,2021). Nevertheless, the large amount of data that AI Agents require can provoke trust issues among customers, which need to be understood to exploit the advantages. A key factor to overcome upcoming barriers is to establish an optimal level of trust between CAs and users and to accept the Agent role as a collaborative figure (Rheu et al., 2020). Users' trust is conditional upon other factors, like the role of the agent, the task context and at hand, and the users' need (Rheu et al., 2021). As a first contact point, CAs

---

[5] BCG How AI Agents Are Opening the Golden Era of Customer Experience.

help customers by connecting via text-based communication for simple queries, but they are increasingly being used for more complex supporting activities. User data can be used to stimulate engagement, which can subsequently be augmented by using CAs. Moreover, bots can avoid providing off-topic information, answering on time and in an appropriate manner (Krishnan et al., 2022).

According to Clark and his colleagues (Clark et al., 2019), users interact with Agents considering them as tools, firstly viewing the conversation as goal-oriented rather than a social interaction. In addition, Nass and Moon (2000) discuss that people's responses to Conversational Agents are frequently automatic, occurring as a mindless process where they focus on social signals rather than agent characteristics. Even though they are still generally used only for utilitarian purposes, the latest consistent evolution of technologies is changing user perceptions towards CAs.

CAs' skills have continuously been improved, making the difference between behaviors and norms in human-human and human-computer conversations increasingly blurred. The level of engagement that a user feels with a CA refers to the perceived ability of the CA to communicate effectively by acting and responding thoughtfully. Through three experiments, Kull et al. (2021) demonstrated that a warm initial message increases the possibility of a longer and more authentic interaction between a CA and a user, highlighting how a first warm message affects a positive user's response. However, Peng et al (2022) studied that, in specific contexts, a high form of familiarity can lead to discomfort, reducing user acceptance.

Users who feel that CAs understand their input and respond appropriately perceive that their queries matter. Conversely, inappropriate responses distract users, leading to less effective communications. Moreover, when a conversation maintains a natural flow, interactions are more engaging. By using tailored responses, organizations that want to create a sense of engagement among their customers after interacting with CAs will gain advantages (Schuetzler et al., 2020).

Before delving into the methodology chapter, the underlying construct map shows the concept model and variables on which the thesis is structured. It links the literature review concepts to the research hypotheses.
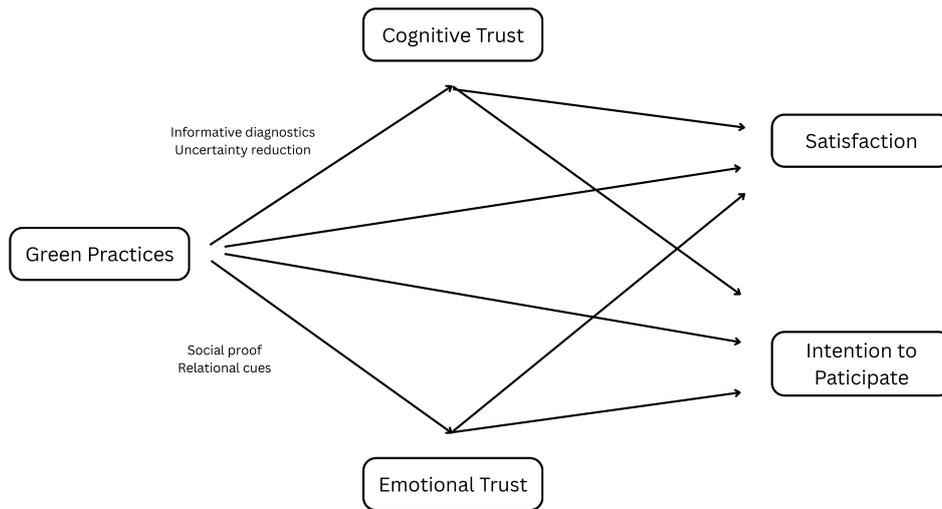
Figure 4: The Construct Map

4 Methodology

The nature of this study is to understand and explain how an AI-Based Conversational Agent is perceived in tennis tournaments as a mediator of green practices for enhancing fans' engagement with sustainability. This section outlines the research methods used to investigate the research question:

"*Can an AI-Based Conversational Agent be leveraged to enhance fan engagement towards sustainability initiatives in contexts like tennis tournaments?*"

It describes the design, hypotheses formulation, data collection and analysis procedures adopted to ensure reliable findings.

4.1 Research design

To better investigate the relationship between tennis tournaments' green initiatives and fans' engagement through an AI-Based Conversational Agent, a quantitative research design was developed for the study. According to Watson (2015), *"quantitative research encompasses a range of methods concerned with the systematic investigation of social phenomena, using statistical or numerical data"*. Therefore, the research assumed that the phenomenon under study could be measured. Data were collected through an online questionnaire and participants were asked to complete it. The purpose was to examine how respondents perceived the green initiatives implemented by a tennis tournament, which included the possibility of interacting with an AI-Based Conversational Agent, and the potential for this to increase the likelihood of engaging in sustainable practices during and after the tournament. The stimulus, meaning the interaction with the CA, was designed as a textual scenario submitted to the survey participants, without any example dialogues or mockup screens.

4.2 Hypotheses formulation

As already discussed, the objective of the research is to understand if the characteristics (cognitive and emotional trust) of an AI-Based Conversational Agent can increase fans' engagement towards sustainable initiatives implemented by a tennis tournament, during and after it. It also explores whether this approach may be considered a strategic way for tennis tournaments to change spectators' behaviors into more sustainable ones.

Considering the evolving setting and present gaps on how fans' engagement toward sustainability initiatives can be bridged, for the research, a scenario was developed. It simulated the attendance at a tennis tournament that decided to implement green initiatives and used AI-Based Conversational Agents to help fans understand and engage with sustainability matters. Participants were asked to imagine interacting with an AI-Based CA that knew and supported sustainability initiatives, even if they had never had a similar experience.

The choice to develop a hypothetical scenario was made because the use of AI-Based technology in sports events is still emerging, limiting real-world observations. In this hypothetical setting, not yet widespread, the study could provide insight into predicted reactions in the tennis context where new technologies are still emerging, as well as evidence on a possible real acceptance of these integrations, making it a useful early-stage exploration. Nevertheless, it has inherent limitations that restrict the possibility of providing higher evidence of the effectiveness of AI characteristics on fans' perceptions and their possible evolution over time.

Based on this scenario, a series of hypotheses were developed to investigate which impact Generative AI's characteristics have on tennis fans' behaviors and choices regarding sustainability and whether this driver could increase their engagement towards environmentally friendly actions.

The hypothesized model shows how green practices enhanced by a tennis tournament impact fans' engagement (satisfaction and intention to participate), mediated by the characteristics of an AI-Based Conversational Agent (perceived cognitive and emotional trust). The potential increased engagement also brings an increasing awareness of environmental issues, enhancing new initiatives also at other sports and social events. Considering that green practices are being enhanced by sports organizations, the thesis empirically examines whether Generative AI (in the form of an AI-Based Conversational Agent) can promote these initiatives for fostering fans' engagement also in their future behaviors.

In addition, as Seneaux (2008) explained, fans are the primary stakeholders who affect, but are also affected by sport organizations; therefore, studying their perceptions is important for

present and future sustainability engagement. Engagement was conceptualized in terms of satisfaction and intention to participate. Satisfaction refers to a post-choice evaluation of an experience (Oliver, 1981) and is used by researchers to study how a paradigm affects consumers' choice. Bhattacherjee (2001) studied the relationship between consumer satisfaction and continuance intentions, showing that there is a strong relationship between the two behaviors. This approach is consistent with the research that studies engagement as an outcome of cognitive and emotional trust involvement.

Consequently, the research question is:

Can an AI-Based Conversational Agent be leveraged to enhance fan engagement towards sustainability initiatives in contexts like tennis tournaments?

According to McCullough and Kellison (2017), climate change is a growing matter for the sports industry, and organizations play a key role in motivating fans to engage in more responsible behaviors. Participants are more likely to adopt personal environmental behaviors if they are exposed to sustainability practices at sports events (McCullough and Kellison, 2016). Considering these observations and the fact that people tend to internalize external values into their own, the related hypotheses concerning the direct effects are:

H1: Green practices at tennis tournaments positively influence spectators' satisfaction
H2: Green practices at tennis tournaments positively influence spectators' intention to participate

Moreover, the literature reviewed the strategic role that AI-Based CAs have in enhancing customer satisfaction and engagement across sectors. As highlighted by Prentice, Weaven & Wong (2020), CAs are increasingly becoming emotional touchpoints thanks to their ability to simulate human-like interaction, fostering a greater perception of trust and competence. Furthermore, Mariani, Hashemi, & Wirtz (2023) highlighted how the relationship between AI technologies and customer engagement has become a source for organizations to understand how to create and measure value. The following hypotheses aim to understand the mediating role that the AI-Based Conversational Agent, introduced at the tennis tournament, has on the previously direct relationships discussed. Gefen et al. (2003) acknowledge that trust is not easy to conceptualize; trusting beliefs can be defined as the trustor's cognitive beliefs resulting from the attributions perceived (e.g., competence and integrity) (Komiak & Benbasat, 2006).

Cognitive trust and emotional trust were both used as separate mediators to study both the rational and affective dimensions of fans' interactions. Indeed, without emotional trust, cognitive trust is an inadequate measure to understand how people make decisions about whether to trust or not (Komiak & Benbasat, 2006). While cognitive trust expressed fans' perceived reliability competence, emotional trust expressed fans' security and emotional connection. Although the setting was hypothetical and short-term, and emotional trust is typically measured through repeated scenarios, it could still be evaluated as a beginning of perceived affective comfort (Schuetzler et al., 2020).

Therefore, these hypotheses follow the idea that AI Agents may play a central mediating role in translating sustainability communication into behavioral results, where trust involves both reasoning and feeling:

H3a: Cognitive trust in the AI-Based Conversational Agent positively influences the relationship between green practices and satisfaction

H3b: Cognitive trust in the AI-Based Conversational Agent positively influences the relationship between green practices and intention to participate

H4a: Emotional trust in the AI-Based Conversational Agent positively influences the relationship between green practices and satisfaction

H4b: Emotional trust in the AI-Based Conversational Agent positively influences the relationship between green practices and intention to participate

4.3 Data collection methods

As mentioned before, the thesis adopted a quantitative research strategy, based on a survey with a structured questionnaire for data collection. In total, 165 participants completed the survey, and data were collected through a purposive sampling technique that involved selecting individuals based on specific characteristics or relevant to the research objectives. Therefore, since the aim was to have a sample as representative as possible, a purposive approach was used by selecting tennis fans. From this perspective, the research targeted primarily people who usually attend a tennis tournament at least once a year.

The survey was divided into five main sections. The first described the general research objectives, explaining the anonymity of the data, ensuring that all respondents were above 18years old. The second part presented the scenario for understanding the questionnaire, where the attendance at a tennis tournament that implemented green initiatives and used AI-Based CAs for a deeper knowledge of sustainability matters was simulated. The third part concentrated on participants' perceptions of the in-place green practices at the tennis tournament. The fourth part focused on the perceived cognitive and emotional trust of participants of the AI-Based Conversational Agent on sustainability knowledge. The final section covered participants' demographic information; they served as control variables, considering that individual characteristics can shape different reactions. Also, having respondents' attendance of at least one tournament per year was used as an important variable because existing behaviors often influence future related ways of behaving.

The scale items used to measure the outcomes were rated on a 7-point Likert scale from "strongly agree" to "strongly disagree". As shown in Table 1, the first section of Fans' Perceptions of Sustainable Initiatives was composed of three constructs: Fans' Perception of Green Practices (PERCSUSTAIN), Fans' Perceived Satisfaction (PERCSATIF) and Fans' Intention to Participate (INTTOPAR). All the constructs contained in the section were adopted from Chaves-Castro et al. (2025).

Green practices are initiatives taken by organizations to reduce the negative environmental impact of their activities. These actions refer to different categories, like waste management, energy and water consumption, facilities management and communication. Sports organizations implement them considering external demand pressures and potential economic and social benefits.

Sport, and in particular tennis, is linked with emotions, which are a state of feelings that impact people's behaviors. They play a pivotal role in the management of sporting events, reflecting participants' experienced satisfaction, which turns into loyalty and retention. Lastly, behavioral

intentions refer to people's way of behaving, considering their feelings. In tennis, these intentions are related to fans' favorable intentions to attend a tournament for the first time, to join future editions, and recommend it to others.

Similarly to the first section, the second, Fans' Perceptions of the AI-Based Conversational Agent, was composed of three constructs: Fans' Perceived Cognitive Trust in Competence (TRUSCOMP), Fans' Perceived Cognitive Trust in Integrity (TRUINTEG), Fans' Perceived Emotional Trust (EMOTRUST). These constructs were measured using the item scale developed by Komiak & Benbasat (2006).

In the context of AI adoption, users' attitudes toward green initiatives were studied considering the voluntary adoption of an AI-Based Conversational Agent and the possibility of a first-hand experience with it. In this relationship was studied the role of perceived trust among fans. Komiak and Benbasat (2004) defined trust, also towards technologies, as a combination of cognitive and emotional trust, considering that trust decisions involve both reasoning and feelings. Cognitive trust is cultivated when a trustor identifies that there are good reasons to trust, based on a series of advantages. Emotional trust is a fan's feeling about relying on CAs for decisions and knowledge. In the study, adapting from Komiak and Benbasat (2004), trust was divided in the following way:

- cognitive trust in competence, which was a fan's rational expectation that a CA was capable of providing good, sustainable recommendations;
- cognitive trust in integrity, which was a fan's rational expectation that a CA provided objective advices;
- emotional trust, which was a fan's feelings of security and comfort about relying on a CA for decisions on sustainable matters.

Hence, trust is a crucial aspect when adopting new digital technologies, such as Generative AI in the form of Conversational Agents. The study sought to investigate whether adopting an AI-Based Conversational Agent with a trust-centered lens and a balance between cognitive and emotional perspectives among fans could increase their engagement towards sustainable initiatives.

Construct	Measure
PERCSUSTAIN: Green Practices	The tennis tournament *would provide* information on caring for the environment.
	At the tournament, I *would be able to access* biodegradable and/or recyclable products.
	At the tournament, I *would be able to consume* organic products.
	At the tournament, *there would be* measures in place to efficiently use water and energy.
	The tournament *would promote* the recycling of waste.
	At the tournament, *there would be* containers to collect waste related to tennis practice.
PERCSATIF: Satisfaction	I *would be happy* with the experience I could have at this tennis tournament.
	I *would truly enjoy* attending this tennis tournament.
	I *would feel emotionally engaged* by the experiences I could have at this tennis tournament.
INTTOPAR: Intention to Participate	I *would feel* a sense of pleasure after participating in this tournament.
	I *would recommend* my friends and family attend this tournament.
	If I have the opportunity to attend this event, I *would definitely go*.
TRUSCOMP: Perceived Cognitive Trust in Competence	The AI-based conversational agent *would be an expert* in assessing sustainable initiatives.
	The AI agent *would have* good knowledge about sustainable initiatives.
TRUINTEG: Perceived Cognitive Trust in Integrity	The AI agent *would provide* unbiased sustainability recommendations.
	The AI agent *would be* honest.
	I *would conside*r this AI agent to be of integrity.
EMOTRUST: Perceived Emotional Trust	I *would feel secure* about relying on the AI agent for my decisions.
	I *would feel content* about relying on the AI agent for my decisions.
	I *would feel comfortable* about relying on the AI agent for my decisions.

Figure 5: Constructs and Measures

4.4 Data analysis

The data analysis was conducted using the Statistical Package for the Social Sciences (SPSS). A series of OLS linear regressions has been developed to test the hypotheses formulated for the study, while the mediations were analyzed using the Process Macro Model 4, with 5.000 bootstrap. For the purpose of the study, the different measures of each construct were grouped under one mean to test the constructs under the different hypotheses. Moreover, responses were translated into numerical data for the statistical analysis.

To test the direct effects, H1 and H2, two linear regressions were employed to identify whether green practices significantly predict fans' perceived satisfaction and intention to participate. In continuation of the analysis, the hypotheses H3 a-b and H4 a-b explored the mediating roles of cognitive trust and emotional trust of an AI-Based CA on the antecedent direct effects between green practices and perceived satisfaction first, and perceived intention to participate after. These mediated effects were tested using the Process Model macro by Andrew Hayes to understand how a third variable would have influenced two constructs (Hair et al., 2009). In particular, a mediator variable acts as an intervening variable that explains the relationship between a predictor variable X and an outcome variable Y. To run the mediation analysis, the statistical Model 4 was used, which exemplifies a simple mediation of the variables:

- M: cognitive trust (H3) and emotional trust (H4)

- X: green practices
- Y: perceived satisfaction (H3a, H4a) and perceived intention to participate (H3b, H4b).
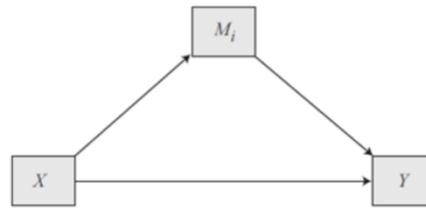
Figure 6: Model 4

5 Results

Before delving into the analysis, it is first necessary to examine the population characteristics. As said, 165 participants completed the survey, and in line with the research target of people attending tennis tournaments at least once a year, the highest percentage of responses corresponded to 28.5%, which targeted participants attending one tournament per year, whereas 23.6% corresponded to more than five times per year.

TENNISTOURN

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 time per year	47	28,5	28,5	28,5
	2–3 times per year	34	20,6	20,6	49,1
	4–5 times per year	11	6,7	6,7	55,8
	More than 5 times per year	39	23,6	23,6	79,4
	Never	34	20,6	20,6	100,0
	Total	165	100,0	100,0	

Figure 7: Frequencies of the variable tennis tournament

Regarding gender, 61% were men, 39% were women, and 1% preferred not to say. All participants were over 18 years, and the majority, 74.5% (123), were between 18-30.

AGE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18–30	123	74,5	74,5	74,5
	31–44	18	10,9	10,9	85,5
	45–59	21	12,7	12,7	98,2
	Over 60	3	1,8	1,8	100,0
	Total	165	100,0	100,0	

Figure 8: Frequencies of the variable age

The results, weighted toward a young sample, are in line with the level of education because 35.8% of the sample had a bachelor's degree, and the highest percentage was given by high school diploma, constituting 38.8% (64).

EDUC

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelor's degree	59	35,8	35,8	35,8
	High school diploma	64	38,8	38,8	74,5
	Master's degree	39	23,6	23,6	98,2
	PhD	3	1,8	1,8	100,0
	Total	165	100,0	100,0	

Figure 9: Frequencies of the variable education

Indeed, regarding the occupational level, 57.6% of the participants were students.

OCCUP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Employee	38	23,0	23,0	23,0
	Retired	2	1,2	1,2	24,2
	Self–employed	28	17,0	17,0	41,2
	Student	95	57,6	57,6	98,8
	Unemployed	2	1,2	1,2	100,0
	Total	165	100,0	100,0	

Figure 10: Frequencies of the variable occupation

Lastly, 95% (156) of the sample were from Europe, with a modest proportion hailing from North America (5%).

Figure 11 provides an overview of the dataset with the descriptive statistics, measuring the mean and standard deviation of fans' perceptions on green initiatives and trust in an AI-Based Conversation Agent. All measures were a 7-point Likert scale with anchors 1= strongly disagree and 7=strongly agree. There was a weak perception of the in-place sustainability initiatives, given the M=1.83 and the SD=0.866. Perceived satisfaction (M=2.07) and intention to participate (M=2.21) were low to moderate, showing a limited fans' engagement. Notably, the results showed that perceived emotional trust in an AI-Based CA has a M=3.23 and SD=1.36. These values were higher than the ones of perceived cognitive trust, signifying that spectators feel emotionally engaged with an AI-Based CA, but still didn't trust its objectivity.

Descriptive Statistics

	N	Mean	Std. Deviation
PERCSUSTAIN	165	1,83	,866
PERCSATIF	165	2,07	,855
INTOOPAR	165	2,21	,928
COTRUST	165	2,53	1,022
EMOTRUST	165	3,23	1,368
Valid N (listwise)	165		

Figure11: Descriptive Statistics of the Variables

Individual item reliability was examined by evaluating each loading on its corresponding construct. Internal consistency of the constructs was measured through the Cronbach's Alpha coefficient. All constructs ranged from 0.816 to 0.92, exceeding the suggested benchmark for ensuring an adequate reliability of 0.70 (Fornell and Larcker,1981). Specifically, green practices had a Cronbach's Alpha of 0.866, satisfaction 0.816, intention to participate 0.837, cognitive trust 0.873 and emotional trust 0.927.

Construct	Number of Items	Cronbach's Alpha (α)
Green Practices	4	0,866
Satisfaction	3	0,816
Intention to Participate	3	0,837
Cognitive Trust	3	0,872
Emotional Trust	3	0,927

Figure 12: Constructs' validity

The analysis results showed that the hypotheses results were all supported, except for H4a, which was rejected because it was not statistically significant. This will be further discussed in Chapter 6.

Concerning the first hypothesis (H1), the regression results indicated a significant positive relationship between green practices at tennis tournaments and fans' satisfaction, based on $\beta = 0.439$ and $p < .001$, in a 95% confidence interval, highlighting that the perception of in place environmentally responsible practices exhibits a higher level of satisfaction.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,269	,140		9,071	<,001
	PERCSUSTAIN	,439	,069	,445	6,347	<,001

a. Dependent Variable: PERCSATIF

Figure 13: Green practices at tennis tournaments positively influence spectators' satisfaction

Similarly, H2 was supported by the statistical significance of the positive effect that green practices have on fans' intention to participate in tennis tournaments, with a $\beta = 0.438$ and a p-value $< .001$.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,408	,155		9,090	<,001
	PERCSUSTAIN	,438	,077	,409	5,715	<,001

a. Dependent Variable: INTTOPAR

Figure 14: Green practices at tennis tournaments positively influence spectators' intention to participate

As already said, the mediating role of cognitive and emotional trust of an AI-Based Conversational Agent was run with the Hayes Process Model. A series of regressions was

estimated to test the validity of the related hypotheses. Hypothesis H3 examined the role of cognitive trust as a mediator. H3a investigated whether cognitive trust positively mediated the relationship between green initiative and satisfaction, whereas H3b examined whether it may positively mediate the relationship between green initiative and intention to participate.

When introducing in the regression model cognitive trust as a mediator between green practice and perceived satisfaction, the results showed that the relationship between green practices and cognitive trust is statistically significant, being $\beta = 0.5659$ and $p < .001$, and also the one between cognitive trust and perceived satisfaction, with $\beta = 0.3248$ and $p < .001$. Consequently, including the mediator in the model has statistically significant results with $\beta = 0.2557$ and $p=.0006$. These results were supported by R^2 which, in linear regression, without mediation, explains 23% of the variance, while in H3a it increases to 31.4%. The mediator, therefore, increased the overall effect of X (green practices) on Y (satisfaction) by 8.4%.

```
**************** PROCESS Procedure for SPSS Version 4.2 ****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
      Documentation available in Hayes (2022). www.guilford.com/p/hayes3

***********************************************************************
Model : 4
    Y  : PERCSATI
    X  : PERCSUST
    M  : COTRUST

Sample
Size:  165

***********************************************************************
OUTCOME VARIABLE:
 COTRUST

Model Summary
         R        R-sq        MSE          F        df1        df2          p
     ,4792       ,2296      ,8103    48,5803     1,0000   163,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     1,4930      ,1641     9,0971      ,0000     1,1689     1,8170
PERCSUST      ,5659      ,0812     6,9700      ,0000      ,4056      ,7262

***********************************************************************
OUTCOME VARIABLE:
 PERCSATI

Model Summary
         R        R-sq        MSE          F        df1        df2          p
     ,5608       ,3145      ,5069    37,1629     2,0000   162,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant      ,7846      ,1594     4,9225      ,0000      ,4698     1,0993
PERCSUST      ,2557      ,0732     3,4944      ,0006      ,1112      ,4001
COTRUST       ,3248      ,0619     5,2432      ,0000      ,2025      ,4471
```

Figure 15: Cognitive trust in the AI-Based Conversational Agent positively influences the relationship between green practices and satisfaction

H3b predicted the mediation of cognitive trust on green practices and intention to participate and was statistically significant. Cognitive trust had a significant positive effect on the mentioned relationship with a β = 0.2537 and p=.0024. As explained before, the results were also supported by R^2 that in linear regression, without mediation, explains 23% of the variance, while in H3b it increases to 26.5%. The mediator, therefore, increased the overall effect of X (green practices) on Y (intention to participate).

```
*************** PROCESS Procedure for SPSS Version 4.2 ***************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
      Documentation available in Hayes (2022). www.guilford.com/p/hayes3

***********************************************************************
Model  : 4
    Y  : INTOOPAR
    X  : PERCSUST
    M  : COTRUST

Sample
Size:  165


***********************************************************************
OUTCOME VARIABLE:
 COTRUST

Model Summary
          R        R-sq        MSE          F        df1        df2          p
      ,4792       ,2296      ,8103    48,5803     1,0000   163,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     1,4930      ,1641     9,0971      ,0000     1,1689     1,8170
PERCSUST      ,5659      ,0812     6,9700      ,0000      ,4056      ,7262

***********************************************************************
OUTCOME VARIABLE:
 INTOOPAR

Model Summary
          R        R-sq        MSE          F        df1        df2          p
      ,5157       ,2659      ,6398    29,3438     2,0000   162,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant      ,9221      ,1791     5,1497      ,0000      ,5685     1,2757
PERCSUST      ,2537      ,0822     3,0870      ,0024      ,0914      ,4160
COTRUST       ,3253      ,0696     4,6748      ,0000      ,1879      ,4628
```

Figure 16: Cognitive trust in the AI-Based Conversational Agent positively influences the relationship between green practices and intention to participate

Going on with the analysis, hypothesis H4 examined the role of emotional trust as a mediator. As outlined for H3, hypothesis H4a refers to the mediation role of emotional trust between green practices and satisfaction, while H4b refers to the mediation role of green practices and intention to participate. In contrast with the previous hypotheses, H4 was partially significant because H4a was not, while H4b was.

As shown in the underlying Figure 17, there was no significant positive mediation of emotional trust in the regression model. If the relationship between green practice and emotional trust was statistically significant with β = 0.4455 and p=.0002, the one between emotional trust and perceived satisfaction was not, with a p-value of .0558, which is >5% of the significance level of acceptance. Therefore, the hypothesis had to be rejected for a 5% level of significance, implying that emotional trust is not the right channel to increase satisfaction.

```
**************** PROCESS Procedure for SPSS Version 4.2 ****************

          Written by Andrew F. Hayes, Ph.D.        www.afhayes.com
     Documentation available in Hayes (2022). www.guilford.com/p/hayes3

************************************************************************
Model  : 4
    Y  : PERCSATI
    X  : PERCSUST
    M  : EMOTRUST

Sample
Size:  165


************************************************************************
OUTCOME VARIABLE:
 EMOTRUST

Model Summary
        R        R-sq       MSE         F        df1        df2          p
     ,2819      ,0795     1,7344    14,0686    1,0000   163,0000      ,0002

Model
              coeff        se         t          p        LLCI       ULCI
constant     2,4119      ,2401    10,0457      ,0000     1,9378     2,8860
PERCSUST      ,4455      ,1188     3,7508      ,0002      ,2110      ,6801


************************************************************************
OUTCOME VARIABLE:
 PERCSATI

Model Summary
        R        R-sq       MSE         F        df1        df2          p
     ,4649      ,2161      ,5796    22,3343    2,0000   162,0000      ,0000

Model
              coeff        se         t          p        LLCI       ULCI
constant     1,0591      ,1766     5,9966      ,0000      ,7103     1,4079
PERCSUST      ,4006      ,0716     5,5973      ,0000      ,2593      ,5419
EMOTRUST      ,0872      ,0453     1,9265      ,0558     -,0022      ,1766
```

Figure 17: Emotional trust in the AI-Based Conversational Agent positively influences the relationship between green practices and satisfaction

Concerning the last hypothesis, H4b, it showed that the relationship between green practices and intention to participate increases when emotional trust plays a mediating role. In contrast with H4a, the indirect effect of emotional trust on intention to participate had a significant effect, explained by a β = 0.1200 and p= .0171, suggesting that the hypothesis was accepted at the 5% level of significance.

```
***************** PROCESS Procedure for SPSS Version 4.2 *****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
     Documentation available in Hayes (2022). www.guilford.com/p/hayes3

**************************************************************************
Model  : 4
    Y  : INTOOPAR
    X  : PERCSUST
    M  : EMOTRUST

Sample
Size:  165

**************************************************************************
OUTCOME VARIABLE:
 EMOTRUST

Model Summary
         R        R-sq       MSE          F        df1        df2          p
      ,2819      ,0795    1,7344    14,0686     1,0000   163,0000      ,0002

Model
             coeff        se         t          p       LLCI       ULCI
constant    2,4119     ,2401   10,0457      ,0000     1,9378     2,8860
PERCSUST     ,4455     ,1188    3,7508      ,0002      ,2110      ,6801

**************************************************************************
OUTCOME VARIABLE:
 INTOOPAR

Model Summary
         R        R-sq       MSE          F        df1        df2          p
      ,4424      ,1957     ,7010    19,7124     2,0000   162,0000      ,0000

Model
             coeff        se         t          p       LLCI       ULCI
constant    1,1184     ,1942    5,7586      ,0000      ,7349     1,5020
PERCSUST     ,3844     ,0787    4,8839      ,0000      ,2290      ,5398
EMOTRUST     ,1200     ,0498    2,4095      ,0171      ,0217      ,2183
```

Figure 18: Emotional trust in the AI-Based Conversational Agent positively influences the relationship between green practices and intention to participate

6   Discussion and practical implications

As environmental concerns intensify and new technologies are adopted, it has become clearer that people's engagement is a pivotal point for organizations. Sport events have a significant environmental footprint, considering the infrastructure needed and the large crowd of spectators. Organizations need to adopt responsible practices and develop solutions to drive fan engagement in sustainability matters.

Sport has the potential to capture the attention and passion of people all over the world, overcoming gaps in geography, language and culture, bringing people together. The sector can benefit from the adoption of technological developments, such as AI, because it has the potential to innovate and transform on a global scale, having a big impact on the event's value. AI enables individualized experiences that meet individual everyday life habits and event expectations (Neuhofer, Magnus, & Celuch, 2021). Its value extends beyond its role in preventive actions, such as minimizing energy and water consumption. It acts as a catalyst for enhancing and facilitating environmental awareness and governance.

Drawing on sport management, sustainability and AI technologies literature, this chapter discusses the results in light of the research question: *Can an AI-Based Conversational Agent be leveraged to enhance fan engagement towards sustainability initiatives in contexts like tennis tournaments?*

Hence, the study tested whether fans' cognitive and emotional trust toward an AI-Based Conversational Agent had a positive effect on fans' engagement with green initiatives at tennis tournaments, increasing their satisfaction and intention to participate. It contributed to the ongoing digital transformation of fans' experiences and the strategic integration of environmental practices and new technologies in sports organizations. Valuable insights were provided for tennis organizers and, more broadly, sports organizations by highlighting the importance of fans' engagement in sustainability events and the introduction of AI-Based CAs as innovative solutions, as discussed further below.

The results demonstrated that green practices had a positive influence on both fans' perceived satisfaction and their intention to participate. However, only the first three hypotheses were statistically significant. Indeed, the indirect effect explained in the hypothesis H4 was partially significant. H4b, which analyzed the positive effect on the relationship between green practices and intention to participate, was significant. In contrast, H4a had a significance level greater than 5%, suggesting that the mediator role of emotional trust in an AI-Based Conversational Agent was not positively affecting the relationship between green practices with satisfaction.

Nevertheless, the result remained under the 10% level of significance, proving that it is still adequate, but with a lower level of significance.

Delving into the first two hypotheses, results confirmed that perceived green practices have a positive direct effect on fans' satisfaction (H1) and fans' intention to participate in sustainable tennis tournaments (H2). They fit with some previous literature conclusions (Hugaerts et al., 2021), which stated that including sustainable practices in sport events impacts not only the image of the organization but also fans' perceptions of the event. They showed that tennis organizations must offer environmentally friendly tournaments that meet spectators' demand and expectations, which in the long run result in satisfaction and repeated participation at a tournament. Therefore, it is in the interest of tennis organizers to drive sustainability actions, which are connected and form shared value.

The findings were also in line with Porter and Kramer (2011) *shared value*, which asserts that sustainable strategies can, at the same time, increase organizational performance and social welfare. They showed that adopting an environmental approach to a tennis tournament could increase its economic value while also generating environmental value for society. This may also encourage other sports organizations, and beyond the sports industry, to put in place sustainability initiatives. According to Potocan and Mulej (2003), the term "green sustainable practices" refers to the alignment between the imperatives and the strategic vision of an organization aimed at preserving and safeguarding human and natural resources for future generations.

As outlined in the literature review, sustainability in the sport sector has evolved slowly, but in recent years this process has accelerated with strategies conforming to the international standards, such as the UNFCCC Sports for Climate Action Framework. Indeed, tennis tournaments, like ATP Finals in Turin or Wimbledon's environmental initiatives, have incorporated environmental initiatives as a pillar of their strategy (ATP Tour, 2023; Wang, 2025).

Global sustainability is grounded on a "twin transition" concept that combines environmentally friendly practices and digitalization for a greener future. Developing strategies that have a positive impact on the environment and leveraging available capabilities and competencies have become primary concerns for sports organizations to minimize waste and negative consequences. Information plays a crucial role in finding a harmonized context between AI-Based technologies and sustainability. Thus, considering the discussed hypotheses and the following ones, the study can contribute to the sustainable sport and new technologies literature in different ways.

Sport organizations use green games to engage fans on sustainability during the events. However, a limitation is that these initiatives are temporary and one-time engagements. To overcome this problem, the research analyzed whether organizations could leverage a valuable asset, an AI-Based Conversational Agent, to enhance fans' sustainable behaviors through cognitive and emotional trust.

Previous research examined how sport organizations can integrate green practices into their businesses to reduce the environmental impact and how these are perceived by sport attendees. This study aimed to provide insights into the possible positive mediator role that Generative AI has in boosting customer engagement towards sustainability practices. Therefore, it amplified the existing knowledge on the relationship between fans' perceptions of green initiatives implemented by tennis tournaments and fans' future behaviors concerning environmental issues.

The thesis examined customer experience in AI-human interactions (Clark et al., 2019; Rhue et al.,2020) by applying it to the sport context, specifically to tennis tournaments. It showed that the role of cognitive trust made AI Agents valuable mediator tools in shaping fans' perceptions, thereby increasing the sustainability communication. On the contrary, emotional trust was not fully perceived as a good mediator by fans, who hesitated to rely on an AI-Based CA for their decisions.

Moving beyond the direct effects, the results of the hypothesis H3 demonstrated that there is a positive effect on the relationship between green practices and satisfaction (H3a), and, respectively, green practices and intention to participate (H3b). This implies that fans who perceive the AI-Based CA as competent and honest are more likely to feel satisfied and intend to participate in sustainable tennis tournaments. In line with the trust literature of Komiak and Benbasat (2006), these findings highlighted that cognitive trust facilitates perceived usefulness and objective alignment, mostly in decision-making contexts. Indeed, the AI value extends beyond its role in preventive actions, such as minimizing energy and water consumption. It acts as a catalyst for enhancing engagement and, in this scenario, facilitating environmental awareness and governance.

In contrast, emotional trust, expressed in the hypothesis H4, which indicated fans' feeling of reassurance and security in relying on a CA, partially confirmed the positive mediation effect, implying that the direct effect of the relationship was not fully affected by the AI-Based CA characteristics. Indeed, emotional trust had a positive effect only on the relationship between green practices and intention to participate, while for satisfaction (H4a), it did not increase.

Overall, the results revealed the nuances of trust-building in AI-human interactions, and they can be traced back to the nature of the research: participants were asked to imagine a scenario with a one-time interaction with a non-existent AI-Based CA. Emotional trust, however, is a slow burn, difficult to assess accurately in an initial reaction because it develops after many interactions and repeated exposures. This expresses that emotional commitment to the AI Agent in a one-time situation is partially sufficient to shape sustainability engagement, when it refers to satisfaction and intention to participate. The need to have repeated interactions is also explained by the engagement paradox, outlined by the means of cognitive trust and emotional trust. Indeed, fans felt more emotionally connected (mean=3.23 > 2.53 of cognitive trust), but this did not predict satisfaction.

Since it is difficult to ask people to imagine a scenario, the rejected hypothesis can be viewed from a different lens: it may be considered a limitation of how emotional trust explains how people relate to non-human agents in low-touch and imagined settings. The results highlighted a potential discrepancy between the model's theoretical assumptions and the empirical setting. As an initial approach, user-agent interactions in the scenario were still perceived as just goal-oriented and utilitarian, rather than relational, as outlined by Nass and Moon (2000) in their study.

In a first-time exposure, one interpretation is linked with the utilitarian nature of the relationship with the CA, where fans use it primarily as an informative tool. Indeed, in a context like a tennis tournament, where spectators need relevant information, they just value the CA competence and reliability, developing trust along cognitive dimensions. This implies that fans view the CA utilitarianism, rather than perceiving an affective connection. Hence, cognitive trust mediated both satisfaction and intention to participate. Conversely, a second interpretation concerns the relational part, where there is a need for repeated exposure to generate emotional engagement. Indeed, emotional trust develops over time as fans live positive experiences that create familiarity and shared emotions.

The two perspectives underline how the utilitarian use of CAs emerges at a first stage, while emotional trust arises over time. Therefore, sports organizers need to design and adopt a dual strategy to effectively communicate green initiatives: in the short-term period, AI technologies can be introduced in sports events to deliver "quick wins" by giving support to the spectator's experience, providing assistance and suggestions for sustainable behaviors (eco-friendly transport or waste disposal points). These interactions increase instant satisfaction towards green efforts. In the long term, considering the possibility of repeated attendance, AI technologies can redefine the sports environment, for example, offering personalized content

and experiences, like loyalty programs, green challenges, or dashboards that track the fan's positive impact at the event. Over time, repetitive interactions can lead to the development of both cognitive and emotional trust (Komiak & Benbasat, 2006), which are key to deepening engagement. These concepts intersect with the previous literature on the convergence of AI technologies and customer experience, where digital tools serve as touchpoints to boost user engagement and personalized experiences (Neuhofer et al., 2021).

In addition, the study offers a starting point for concrete operational steps that sport organizers can put into practice. In particular, three priorities emerge as recommendations for tournament organizers:

- Design green FAQs within apps or venue interfaces that answer fans' sustainability questions in an accessible and trustworthy way;
- Introduce mobility nudges with personalized and real-time travel footprint data, with additional options such as low-carbon travel possibilities;
- Develop personal dashboards of the avoided impacts to help fans understand the environmental benefits of their choices and contributions over time;
- Link the in-practice green efforts to specific storytelling, such as narrating the life-cycle of the materials, the local suppliers or the eco-commitments, to create an AI-human bond.

When sports organizers consider practical aspects, they have to take into consideration costs, resource allocation and operational changes. Concerning this point, scalability and adaptability of future actions are fundamental for being valuable across types and sizes of sport facilities. In this way, collaborations within and across organizations can increase to develop more effective AI-Based solutions that align with sustainability initiatives.

Generally, respondents' perceptions were very different, raising questions about the factors driving these differences. This reveals how people's future behaviors still need to be influenced, without just focusing on acting properly in the involved tournament. For instance, this discrepancy could have been influenced by social norms or past experiences. If spectators have seen that sustainability initiatives are just a one-time situation at tennis tournaments, they may have embraced this trend, assuming organizations usually act differently, considering the context. For this reason, sports organizations should not only prioritize the implementation of green practices but also develop strategic communication and engagement efforts, such as AI-Based Conversational Agents, that aim at raising spectators' engagement and fostering a long-term commitment to sustainability, beyond the confines of the single event.

To bridge the gap between sustainability practices and an AI-Based CAs, the findings indicated that cognitive and emotional trust in AI technologies adoption for fans' engagement is appropriate, even if in two distinctive ways. Cognitive trust sheds light on the applications in low-touch contexts, while emotional trust threw light upon the fact that one-off engagement is not enough to have a full engagement by the fans; rather, it needs repeated interactions. Tennis organizers should rely on AI cognitive solutions in event applications and digital interfaces. In this way, tournaments can address the low awareness explained in the introduction, provide contextual information on the sustainable practices in place, and create a continuous engagement after the event.

7 Limitations and future research

The study provided insights into the possible integration of the characteristics of AI technologies in tennis tournaments to understand if there was a positive mediation on the relationship between green practices and fans' perceptions. However, like all research, some limitations can influence the generalizability and applicability of the findings. They need to be considered for guiding future recommendations and ensuring a comprehensive understanding of the topic.

First, the sample was composed mainly of 18-30 years old digitally literate students. Indeed, the survey was carried out through tennis fan communities and university social media. This shaped the results because even if they are more likely to be comfortable with AI-Based tools and sustainability messaging, they don't reflect how broader or diverse groups would have responded.

Second, the research was limited to tennis fans, which may limit the generalizability of the results also for other sports. On one hand, future research should also explore and compare other sport organizations, involve different sports and consider a cross-cultural approach. In this way, different segment groups could be studied for a wider understanding during sports events of the acceptance of green practices and potential future engagement. On the other hand, tennis organizers should target the fans to get insights into their contextual preferences and tailor the experiences.

Third, the constructs were measured with a self-administered survey that, despite the validity and reliability obtained, depends on the ability of respondents to answer properly. They may have answered thinking of what is socially acceptable rather than their actual behavior. In this way, it is challenging to determine how to intervene and to predict long-term attitudes without experimenting them first.

Lastly, the study was based on a one-time scenario, where the fan had to imagine interacting with an agent that did not exist. This affected the way of measuring trust and participation intention, because maybe in real situations, fans would have behaved differently, considering the higher complexity and interactions over time. Given the situation of a one-time tennis tournament, future research should focus on repeating this study in real-world and repeated settings. In this way, they can see whether emotional trust can emerge over time, also for the perceived satisfaction, and how it can influence fans' engagement differently from cognitive trust.

Sustainability approach must be more holistic, considering interdependencies and interconnections that go beyond the analysis of the single event. Tennis organizations must start researching whether, in a real tournament, fans' perceptions would have been different and make a comparison with a hypothesized situation. In practice, as mentioned also in the previous chapter, this can be outlined by the importance of designing and placing AI-Based CAs to increase fans' emotional trust in addition to cognitive trust. For example, emotional trust could be increased when asking questions, by providing interfaces for a better understanding, or assigning to CAs personalities similar to the fans' own (Al-Natour et al., 2005). In tennis, and more generally in the sports context, spectators' trust is particularly important, especially if under review is the development of an interpersonal relationship with an AI-Based Conversational Agent, which represents the personal needs and goals of a particular attendee's experience.

From the research, it emerged that there is an evident intersection between AI technology and sustainability, in particular, the pivotal role that it has in shaping future directions. In the long run, sustainability initiatives in tennis tournaments will fulfill environmental responsibilities, but also create business opportunities. As spectators are the main attendees of future tournaments, tennis events are enhancing their long-term competitiveness through green initiatives. Future studies should aim to include a broader array of respondents, considering different geographical locations and demographic backgrounds, to make the findings more globally applicable.

The studied relationships extended the current understanding and actions concerning the environment in sport management, which are expected to play a crucial role in the upcoming years. Indeed, they represent a starting point for further analyses for implementing sustainability strategies in the management of sporting events. Future research can also explore how the model works in other sports, such as football or Formula 1, to understand differences in digital and environmental strategy integration from the fans' perspective and compare them with those in tennis.

What is crucial is incorporating experimental elements, like specific AI technologies in support of sustainability initiatives in controlled and repeated settings, which can provide higher evidence of their effectiveness on fans' perceptions and their possible evolution over time. It is still not clear what the difference is between cognitive and emotional trust in terms of causes and consequences when interacting with an AI-Based CA, and how to fully increase emotional trust in the user-machine interactions. Future directions should understand how to make AI-Based CAs more emotionally sensitive to close the gap observed for the emotional trust

hypothesis H4a. In this way, the evolution of emotional trust and, therefore, fans' engagement can be observed over time from the two trust perspectives, to comprehend how to manage consequent solutions and initiatives.

By addressing the limitations of the study and the recommendations, the thesis can be a starting point for more robust future research that can help tennis organizations and sports develop valid instruments to foster a sustainability engagement to be widely accepted by fans, in an increasingly digital environment.

Conclusion

The study investigated the role of AI technologies and green practices in tennis tournaments, drawing on literature from sustainability in sport events and tennis and AI technologies and customer experience. Through the examination of 165 tennis fans, this research extended the current understanding of whether the mediation of an AI-Based Conversational Agent can positively impact the effect of perceived green initiatives on fans' satisfaction and intention to participate in sustainable contexts like tennis tournaments.

The main findings revealed that perceived green practices positively affect both fans' satisfaction and behavioral intentions, strengthening the importance of leveraging sustainability strategies for sport organizations. Cognitive trust was a good mediator between green practices and fans' engagement, whereas emotional trust towards an AI-Based Conversational Agent was not a fully significant factor affecting this relationship. This indicates that this characteristic is still not sufficient to drive future behaviors in a one-time setting when considering fans' engagement under the satisfaction lens. Therefore, the key takeaway is that cognitive trust in an AI-Based CA helps engage fans with sustainability initiatives, but emotional trust does not yet, given a one-time interaction.

It is important to identify the channel processes that enable organizers to be aligned strategically with the sustainability agenda and, more crucially, the factors that shape green efforts and tactics. Relevant efforts can boost action-based solutions like partnerships with organizations within the same sectors, with a possible subsequent evolution of cross-industry alliances. In this way, an environmental mindset sets collective actions across shareholders, not only of the tennis tournaments, but also for the wider range of sports events' planning. Fans today desire authentic and interactive experiences, where AI technologies can meet their expectation, enhancing their engagement.

Both theoretically and practically, the study made some contributions. It bridged the gap in the adoption of AI-Based technologies, and specifically, Conversational Agents, in tennis tournaments, to foster fans' behavioral changes. It suggested that sport organizers can strategically leverage cognitive trust in AI Agents to improve sustainability communication, raise awareness, and increase long-term fans' engagement, while emotional trust needs more in-depth and real-context studies.

In conclusion, the thesis talked directly to a key sport stakeholder that can foster environmental change: fans. Indeed, the research was a first step toward the exploration of fans' perceptions of the implementation of AI technologies, which tennis tournaments can use to foster a higher

sustainability message. AI-Based Conversational Agents, under a cognitive trust perspective and one-time scenario, are already effective vehicles for enhancing fans' satisfaction and intention to participate in sustainability sport events. Therefore, AI solutions and environmental concerns are also becoming central for sports organizations, which have to integrate trustworthy and emotionally engaging AI technologies. If designed and implemented thoughtfully, AI-Based Conversational Agents can become a key tool for turning passive fans into active participants in sport's green transition.

8 References

A record-breaking Australian Open: AO 2024 by the numbers. (2024, January 31). AO. https://ausopen.com/articles/news/record-breaking-australian-open-ao-2024-numbers

Al-Natour, S., Benbasat, I., & Cenfetelli, R. T. (2005). The role of similarity in e-commerce interactions: The case of online shopping assistants.

Al-Sharafi, M. A., Al-Emran, M., Arpaci, I., Iahad, N. A., AlQudah, A. A., Iranmanesh, M., & Al-Qaysi, N. (2023). Generation Z use of artificial intelligence products and its impact on environmental sustainability: A cross-cultural comparison. *Computers in Human Behavior*, *143*, 107708.

Araujo, T. (2018). Living up to the chatbot hype: The influence of anthropomorphic design cues and communicative agency framing on conversational agent and company perceptions. *Computers in human behavior*, *85*, 183-189.

Arvidsson, S., & Dumay, J. (2021). Corporate ESG reporting quantity, quality and performance: Where to now for environmental policy and practice? *Business Strategy and the Environment*, *31*(3), 1091–1110.

ATP Sustainability Report. (n.d.). https://sustainability.atptour.com/2023/1-1/

Barker, R., & Eccles, R. G. (2018). Should FASB and IASB be responsible for setting standards for nonfinancial information? *SSRN Electronic Journal*.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology*, *51*(6), 1173.

Bianchini, A., & Rossi, J. (2021). Design, implementation and assessment of a more sustainable model to manage plastic waste at sport events. *Journal of Cleaner Production*, *281*, 125345.

Bowen, J., & Morosan, C. (2018). Beware hospitality industry: the robots are coming. *Worldwide Hospitality and Tourism Themes*, *10*(6), 726-733.

Casheekar, A., Lahiri, A., Rath, K., Prabhakar, K. S., & Srinivasan, K. (2024). A contemporary review on chatbots, AI-powered virtual conversational agents, ChatGPT: Applications, open challenges and future research directions. *Computer Science Review*, *52*, 100632.

Cayolla, R. R., Escadas, M., Biscaia, R., Kellison, T., Quintela, J. A., & Santos, T. (2023). Fans' perceptions of pro-environmental sustainability initiatives in sport and triple bottom line benefits. *International Journal of Sports Marketing and Sponsorship*, *24*(2), 395-421.

Cayolla, R. R., Santos, T., & Quintela, J. A. (2021). Sustainable Initiatives in Sports Organizations—Analysis of a group of stakeholders in Pandemic times. *Sustainability*, *13*(16), 9122.

Chaves-Castro, K., Morán-Gámez, G., Nuviala, A., & Fernández-Martínez, A. (2025). Green practices and sustainability as precursors to the intention to participate again in sporting events held in nature. *Frontiers in Sports and Active Living*, *7*, 1541485.

Chong, Y. (2024, September 23). *ESG in Sports: A Sustainable Future for the Global Industry - Asian Impact Management Review (AIMR) | Asian Impact Management Review*. Asian Impact Management Review (AIMR) | Asian Impact Management Review. https://www.aimr.asia/impact-reporting/esg-in-sports-a-sustainable-future-for-the-global-industry/

Chopra, K., & Wallace, W. A. (2003, January). Trust in electronic environments. In *36th Annual Hawaii International Conference on System Sciences, 2003. Proceedings of the* (pp. 10-pp). IEEE.

Clark, L., Pantidi, N., Cooney, O., Doyle, P., Garaialde, D., Edwards, J., Spillane, B., Gilmartin, E., Murad, C., Munteanu, C., Wade, V., & Cowan, B. R. (2019). What makes a good conversation? Challenges in designing truly conversational agents. Conference on Human Factors in Computing Systems - Proceedings.

Earthscan.Fotea, S. L., Fotea, I. Ş., & Văduva, S. A. (2020). *Challenges and opportunities to develop organizations through creativity, technology and ethics: The 2019 Griffiths School of Management Annual Conference on Business, Entrepreneurship and Ethics (GSMAC)*. Springer Nature.

EY Parthenon (2022). *How your corporate strategy can deliver both growth and sustainability.* https://www.ey.com/en_gl/real-world-strategy/how-your-corporate-strategy-can-deliver-both-growth-and-sustainability

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of marketing research*, *18*(1), 39-50.

Fulton, B. (2023, September 20). *How sporting events can score big on sustainability*. INSEAD Knowledge. https://knowledge.insead.edu/responsibility/how-sporting-events-can-score-big-sustainability

Gao, L., Li, G., Tsai, F., Gao, C., Zhu, M., & Qu, X. (2023). The impact of artificial intelligence stimuli on customer engagement and value co-creation: the moderating role of customer ability readiness. *Journal of Research in Interactive Marketing*, *17*(2), 317-333.

Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and TAM in online shopping: An integrated model. *MIS quarterly*, 51-90.

Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and TAM in online shopping: An integrated model. *MIS quarterly*, 51-90.

Gollagher, P., & Fastenrath, S. (2023). Transformative climate resilience and sport mega-events–The case of the Australian Open. *Environmental Innovation and Societal Transitions*, *48*, 100762.

GRI - Events. (n.d.). https://www.globalreporting.org/news/events/

Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (2014), Multivariate Data Analysis: Pearson New International Edition, 7th ed., Pearson Education, Harlow.

Henriques, A., & Richardson, J. (2013). *The triple bottom line: Does It All Add Up*.

Hugaerts, I., Scheerder, J., Helsen, K., Corthouts, J., Thibaut, E., & Könecke, T. (2021). Sustainability in participatory sports events: The development of a research instrument and empirical insights. *Sustainability*, *13*(11), 6034.

Hugaerts, I., Scheerder, J., Helsen, K., Corthouts, J., Thibaut, E., & Könecke, T. (2021). Sustainability in participatory sports events: The development of a research instrument and empirical insights. *Sustainability*, *13*(11), 6034.

IBM. *Artificial intelligence*. IBM Think. (2024). https://www.ibm.com/think/topics/artificial-intelligence

ISO 20121:2024. (n.d.). ISO. https://www.iso.org/standard/86389.html

Julia Wiesinger, Patrick Marlow and Vladimir Vuskovic (2024). Agents.

Komiak, N., & Benbasat, N. (2006). The effects of personalization and familiarity on trust and adoption of recommendation agents. *MIS Quarterly*, *30*(4), 941.

Komiak, S. X., & Benbasat, I. (2004). Understanding customer trust in agent-mediated electronic commerce, web-mediated electronic commerce, and traditional commerce. *Information technology and management*, *5*, 181-207.

Krishnan, C., Gupta, A., Gupta, A., & Singh, G. (2022). Impact of artificial intelligence-based chatbots on customer engagement and business growth. In *Deep learning for social media data analytics* (pp. 195-210). Cham: Springer International Publishing.

Kull, A. J., Romero, M., & Monahan, L. (2021). How may I help you? Driving brand engagement through the warmth of an initial chatbot message. *Journal of business research*, *135*, 840-850.

Leal, G. G., Fa, M. C., & Pasola, J. V. (2003). Using environmental management systems to increase firms' competitiveness. *Corporate Social Responsibility and Environmental Management*, *10*(2), 101–110.

Lee, V., Loveys, B., Singh, A., & Yates, R. (2020). *Communicating with Your Customers*.

Mahoney, L. S., Thorne, L., Cecil, L., & LaGore, W. (2012). A research note on standalone corporate social responsibility reports: Signaling or greenwashing? *Critical Perspectives on Accounting*, *24*(4–5), 350–359.

Mallen, C., Stevens, J., & Adams, L. J. (2011). A content analysis of environmental sustainability research in a sport-related journal sample. *Journal of Sport Management*, *25*(3), 240-256.

Mariani, M. M., Hashemi, N., & Wirtz, J. (2023). Artificial intelligence empowered conversational agents: A systematic literature review and research agenda. *Journal of Business Research*, *161*, 113838.

Martin. (2024b, August 29). *The Sustainable Development Agenda - United Nations Sustainable Development*. United Nations Sustainable Development. https://www.un.org/sustainabledevelopment/development-agenda/

Matten, D., & Moon, J. (2008). "Implicit" and "Explicit" CSR: A conceptual framework for a comparative understanding of corporate social responsibility. *Academy of Management Review*, *33*(2), 404–424.

McCullough, B. P., & Cunningham, G. B. (2010). A conceptual model to understand the impetus to engage in and the expected organizational outcomes of green initiatives. *Quest*, *62*(4), 348-363.

McCullough, B. P., Pelcher, J., & Trendafilova, S. (2020). An exploratory analysis of the environmental sustainability performance signaling communications among North American sport organizations. *Sustainability*, *12*(5), 1950.

McCullough, B. P., Pfahl, M. E., & Nguyen, S. N. (2016). The green waves of environmental sustainability in sport. *Sport in society*, *19*(7), 1040-1065.

McCullough, B., & Kellison, T. (2016). Go green for the home team: Sense of place and environmental sustainability in sport.

McCullough, B.P. and Kellison, T.B. (2017), *Routledge Handbook of Sport and the Environment*, Routledge, New York.

Mehmood, K., Kiani, A., Rehman, H., Alshibani, S. M., & Piccardi, P. (2024). Can platform leadership drive twin transitions in greening SMES? Exploring the nexus between AI

infrastructure flexibility, information effects, and green sustainable practices. *Business Ethics the Environment & Responsibility*.

Miklosik, A., Evans, N., & Qureshi, A. M. A. (2021). The use of chatbots in digital business transformation: A systematic literature review. *Ieee Access*, *9*, 106530-106539.

Nass, C., & Moon, Y. (2000). Machines and mindlessness: Social responses to computers. *Journal of social issues*, *56*(1), 81-103.

Neuhofer, B., Magnus, B., & Celuch, K. (2021). The impact of artificial intelligence on event experiences: a scenario technique approach. *Electronic Markets*, *31*(3), 601–617.

Nitto ATP Finals 2024, il progetto per la sostenibilità. (2024, November 10). Federtennis. https://www.fitp.it/Federazione/News/Attivita-internazionale/nitto-atp-finals-progetto-sostenibilita

Official Site of Men's Professional Tennis | ATP Tour | Tennis. (n.d.). ATP Tour. https://www.atptour.com/en

Oliver, R. L., & Linda, G. (1981). Effect of Satisfaction and its Antecedents on Consumer Preference and Intention. *Advances in consumer research*, *8*(1).

Peng, C., van Doorn, J., Eggers, F., & Wieringa, J. E. (2022). The effect of required warmth on consumer acceptance of artificial intelligence in service: The moderating role of AI-human collaboration. *International Journal of Information Management*, *66*, 102533.

Porter, M. E. and M. R. Kramer. 2011. Creating shared value: How to reinvent capitalism and unleash a wave of innovation and growth. *Harvard Business Review*, 62-77.

Potocan, V., & Mulej, M. (2003). On requisitely holistic understanding of sustainable development from business viewpoints. *Systemic Practice and Action Research*, *16*, 421-436.

Prentice, C., & Nguyen, M. (2020). Engaging and retaining customers with AI and employee service. *Journal of retailing and consumer services*, *56*, 102186.

Prentice, C., Weaven, S., & Wong, I. A. (2020). Linking AI quality performance and customer engagement: The moderating effect of AI preference. *International Journal of Hospitality Management*, *90*, 102629.

PwC. *ESG strategy*. https://www.pwc.com/cz/en/sluzby/sustainability/esg-strategie.html

Rheu, M., Shin, J. Y., Peng, W., & Huh-Yoo, J. (2020). Systematic Review: Trust-Building Factors and Implications for Conversational Agent Design. *International Journal of Human-Computer Interaction*, *37*(1), 81–96.

Rheu, M., Shin, J. Y., Peng, W., & Huh-Yoo, J. (2021). Systematic review: Trust-building factors and implications for conversational agent design. *International Journal of Human–Computer Interaction, 37*(10), 928–944.

Schuetzler, R. M., Grimes, G. M., & Scott Giboney, J. (2020). The impact of chatbot conversational skill on engagement and perceived humanness. *Journal of Management Information Systems*, *37*(3), 875-900.

Senaux, B. (2008). A stakeholder approach to football club governance. *International Journal of Sport Management and Marketing*, *4*(1), 4-17.

Sestino, A., Rizzo, C., Irgang, L., & Stehlíková, B. (2025). Redesigning healthcare service delivery processes through medical chatbot integrations: balancing chatbot features and patients' individual differences. *Business Process Management Journal*.

Sidner, C. L., Lee, C., Kidd, C. D., Lesh, N., & Rich, C. (2005). Explorations in engagement for humans and robots. *Artificial Intelligence*, *166*(1-2), 140-164.

Sorrentini, A., & Pianese, T. (2011). The relationships among stakeholders in the organization of men's professional tennis events. *Global Business and Management Research: An International Journal*, *3*(2), 141-156.

Sotiriadou, P., & Hill, B. (2015). Raising environmental responsibility and sustainability for sport events: A systematic review. *International journal of event management research*, *10*(1), 1-11.

Tordjman, K. L., MacDonald, D., Gerrard, P., Derow, R., Scott, B., Poria, K., Bell, R., & Irwin, M. (2025, February 11). *How AI agents are opening the golden era of customer experience.* BCG Global. https://www.bcg.com/publications/2025/how-ai-agents-opening-golden-era-customer-experience

Trendafilova, S., Pelcher, J., Graham, J., & Ziakas, V. (2021). The ebbs and flows of green waves: environmental sustainability in Grand Slam tennis. *Sport, Business and Management: An International Journal*, *11*(3), 302-320.

Tripathi, S., Bachmann, N., Brunner, M., Rizk, Z., & Jodlbauer, H. (2024). Assessing the current landscape of AI and sustainability literature: identifying key trends, addressing gaps and challenges. *Journal of Big Data*, *11*(1).

United Nations Framework Convention on Climate Change (UNFCCC). (2020). *Sports for Climate Action Framework.* United Nations.

Wang, D. (2025). Sustainability and economic responsibility in tennis tournaments. *Advances in Economics Management and Political Sciences*, *138*(1), 34–40.

Watson, R. (2015). Quantitative research. *Nursing standard*, *29*(31).

Zechiel, F., Blaurock, M., Weber, E., Büttgen, M., & Coussement, K. (2024b). How tech companies advance sustainability through artificial intelligence: Developing and evaluating an AI x Sustainability strategy framework. *Industrial Marketing Management*, *119*, 75–89.

9 Appendix

9.1 Frequencies

TENNISTOURN

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 time per year	47	28,5	28,5	28,5
	2–3 times per year	34	20,6	20,6	49,1
	4–5 times per year	11	6,7	6,7	55,8
	More than 5 times per year	39	23,6	23,6	79,4
	Never	34	20,6	20,6	100,0
	Total	165	100,0	100,0	

GENDER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	64	38,8	38,8	38,8
	Male	100	60,6	60,6	99,4
	Prefer not to say	1	,6	,6	100,0
	Total	165	100,0	100,0	

AGE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18–30	123	74,5	74,5	74,5
	31–44	18	10,9	10,9	85,5
	45–59	21	12,7	12,7	98,2
	Over 60	3	1,8	1,8	100,0
	Total	165	100,0	100,0	

GEOG

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Europe	156	94,5	94,5	94,5
	North America	8	4,8	4,8	99,4
	South America	1	,6	,6	100,0
	Total	165	100,0	100,0	

EDUC

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelor's degree	59	35,8	35,8	35,8
	High school diploma	64	38,8	38,8	74,5
	Master's degree	39	23,6	23,6	98,2
	PhD	3	1,8	1,8	100,0
	Total	165	100,0	100,0	

OCCUP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Employee	38	23,0	23,0	23,0
	Retired	2	1,2	1,2	24,2
	Self-employed	28	17,0	17,0	41,2
	Student	95	57,6	57,6	98,8
	Unemployed	2	1,2	1,2	100,0
	Total	165	100,0	100,0	

Appendix A: Demographic information

Descriptive Statistics

	N	Mean	Std. Deviation
PERCSUSTAIN	165	1,83	,866
PERCSATIF	165	2,07	,855
INTOOPAR	165	2,21	,928
COTRUST	165	2,53	1,022
EMOTRUST	165	3,23	1,368
Valid N (listwise)	165		

Appendix B: Descriptive Statistics of the Variables

9.2 Constructs' reliability

Reliability Statistics

Cronbach's Alpha	N of Items
,866	6

Item Statistics

	Mean	Std. Deviation	N
PERCSUSTAIN_1	2,23	1,296	165
PERCSUSTAIN_2	2,12	1,369	165
PERCSUSTAIN_3	2,32	1,153	165
PERCSUSTAIN_4	2,01	1,276	165
PERCSUSTAIN_5	2,01	1,431	165
PERCSUSTAIN_6	2,10	1,291	165

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PERCSUSTAIN_1	10,56	25,418	,737	,830
PERCSUSTAIN_2	10,67	24,868	,731	,830
PERCSUSTAIN_3	10,47	28,543	,556	,860
PERCSUSTAIN_4	10,79	26,900	,619	,850
PERCSUSTAIN_5	10,78	24,806	,692	,838
PERCSUSTAIN_6	10,69	26,593	,636	,848

Reliability Statistics

Cronbach's Alpha	N of Items
,816	3

Item Statistics

	Mean	Std. Deviation	N
PERCSATIF_1	1,94	,895	165
PERCSATIF_2	2,01	,930	165
PERCSATIF_3	2,27	1,154	165

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PERCSATIF_1	4,28	3,556	,657	,765
PERCSATIF_2	4,21	3,213	,748	,673
PERCSATIF_3	3,95	2,803	,632	,810

Reliability Statistics

Cronbach's Alpha	N of Items
,837	3

Item Statistics

	Mean	Std. Deviation	N
INTTOPAR_1	2,27	1,112	165
INTTOPAR_2	2,22	1,127	165
INTTOPAR_3	2,13	,960	165

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
INTTOPAR_1	4,35	3,632	,680	,794
INTTOPAR_2	4,41	3,474	,715	,758
INTTOPAR_3	4,49	4,069	,712	,768

Reliability Statistics

Cronbach's Alpha	N of Items
,873	5

Item Statistics

	Mean	Std. Deviation	N
TRUSCOMP_1	2,59	1,230	165
TRUSCOMP_2	2,30	1,241	165
TRUINTEG_1	2,58	1,235	165
TRUINTEG_2	2,42	1,274	165
TRUINTEG_3	2,75	1,296	165

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
TRUSCOMP_1	10,05	17,644	,676	,852
TRUSCOMP_2	10,34	17,506	,683	,850
TRUINTEG_1	10,05	17,210	,722	,841
TRUINTEG_2	10,21	16,997	,715	,843
TRUINTEG_3	9,89	16,927	,706	,845

Reliability Statistics

Cronbach's Alpha	N of Items
,927	3

Item Statistics

	Mean	Std. Deviation	N
EMOTRUST_1	3,07	1,429	165
EMOTRUST_2	3,24	1,477	165
EMOTRUST_3	3,37	1,487	165

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
EMOTRUST_1	6,61	8,106	,824	,916
EMOTRUST_2	6,44	7,468	,892	,861
EMOTRUST_3	6,31	7,715	,839	,905

Appendix C: Cronbach's Alpha

9.3 Linear regressions

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	PERCSUSTAIN[b]	.	Enter

a. Dependent Variable: PERCSATIF
b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,445[a]	,198	,193	,768

a. Predictors: (Constant), PERCSUSTAIN

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	23,741	1	23,741	40,287	<,001[b]
	Residual	96,053	163	,589		
	Total	119,794	164			

a. Dependent Variable: PERCSATIF
b. Predictors: (Constant), PERCSUSTAIN

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1,269	,140		9,071	<,001
	PERCSUSTAIN	,439	,069	,445	6,347	<,001

a. Dependent Variable: PERCSATIF

Appendix D: Green practices at tennis tournaments positively influence spectators' satisfaction

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	PERCSUSTAIN[b]	.	Enter

a. Dependent Variable: INTTOPAR
b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,409[a]	,167	,162	,849

a. Predictors: (Constant), PERCSUSTAIN

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	23,565	1	23,565	32,656	<,001[b]
	Residual	117,624	163	,722		
	Total	141,189	164			

a. Dependent Variable: INTTOPAR
b. Predictors: (Constant), PERCSUSTAIN

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1,408	,155		9,090	<,001
	PERCSUSTAIN	,438	,077	,409	5,715	<,001

a. Dependent Variable: INTTOPAR

Appendix E: Green practices at tennis tournaments positively influence spectators' intention to participate

9.4 Hayes Process Model 4

```
***************** PROCESS Procedure for SPSS Version 4.2 *****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
       Documentation available in Hayes (2022). www.guilford.com/p/hayes3

*************************************************************************
Model  : 4
   Y  : PERCSATI
   X  : PERCSUST
   M  : COTRUST

Sample
Size:  165


*************************************************************************
OUTCOME VARIABLE:
 COTRUST

Model Summary
         R        R-sq        MSE          F        df1        df2          p
      ,4792      ,2296      ,8103    48,5803     1,0000   163,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant    1,4930      ,1641     9,0971      ,0000     1,1689     1,8170
PERCSUST     ,5659      ,0812     6,9700      ,0000      ,4056      ,7262

*************************************************************************
OUTCOME VARIABLE:
 PERCSATI

Model Summary
         R        R-sq        MSE          F        df1        df2          p
      ,5608      ,3145      ,5069    37,1629     2,0000   162,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     ,7846      ,1594     4,9225      ,0000      ,4698     1,0993
PERCSUST     ,2557      ,0732     3,4944      ,0006      ,1112      ,4001
COTRUST      ,3248      ,0619     5,2432      ,0000      ,2025      ,4471
```

Appendix F: Cognitive trust in the AI-Based Conversational Agent positively influences the relationship between

green practices and satisfaction

```
***************** PROCESS Procedure for SPSS Version 4.2 *****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
       Documentation available in Hayes (2022). www.guilford.com/p/hayes3

*************************************************************************
Model  : 4
   Y  : INTOOPAR
   X  : PERCSUST
   M  : COTRUST

Sample
Size:  165


*************************************************************************
OUTCOME VARIABLE:
 COTRUST

Model Summary
         R        R-sq        MSE          F        df1        df2          p
      ,4792      ,2296      ,8103    48,5803     1,0000   163,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant    1,4930      ,1641     9,0971      ,0000     1,1689     1,8170
PERCSUST     ,5659      ,0812     6,9700      ,0000      ,4056      ,7262

*************************************************************************
OUTCOME VARIABLE:
 INTOOPAR

Model Summary
         R        R-sq        MSE          F        df1        df2          p
      ,5157      ,2659      ,6398    29,3438     2,0000   162,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     ,9221      ,1791     5,1497      ,0000      ,5685     1,2757
PERCSUST     ,2537      ,0822     3,0870      ,0024      ,0914      ,4160
COTRUST      ,3253      ,0696     4,6748      ,0000      ,1879      ,4628
```

```
**************** PROCESS Procedure for SPSS Version 4.2 ****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
       Documentation available in Hayes (2022). www.guilford.com/p/hayes3

*************************************************************************
Model  : 4
    Y  : PERCSATI
    X  : PERCSUST
    M  : EMOTRUST

Sample
Size:  165

*************************************************************************
OUTCOME VARIABLE:
 EMOTRUST

Model Summary
         R        R-sq        MSE          F        df1        df2          p
     ,2819       ,0795     1,7344    14,0686     1,0000   163,0000      ,0002

Model
              coeff         se          t          p       LLCI       ULCI
constant     2,4119      ,2401    10,0457      ,0000     1,9378     2,8860
PERCSUST      ,4455      ,1188     3,7508      ,0002      ,2110      ,6801

*************************************************************************
OUTCOME VARIABLE:
 PERCSATI

Model Summary
         R        R-sq        MSE          F        df1        df2          p
     ,4649       ,2161      ,5796    22,3343     2,0000   162,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     1,0591      ,1766     5,9966      ,0000      ,7103     1,4079
PERCSUST      ,4006      ,0716     5,5973      ,0000      ,2593      ,5419
EMOTRUST      ,0872      ,0453     1,9265      ,0558     -,0022      ,1766
```

```
***************** PROCESS Procedure for SPSS Version 4.2 *****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
     Documentation available in Hayes (2022). www.guilford.com/p/hayes3

*************************************************************************
Model  : 4
    Y  : INTOOPAR
    X  : PERCSUST
    M  : EMOTRUST

Sample
Size:  165


*************************************************************************
OUTCOME VARIABLE:
 EMOTRUST

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,2819      ,0795     1,7344    14,0686     1,0000   163,0000      ,0002

Model
              coeff         se          t          p       LLCI       ULCI
constant     2,4119      ,2401    10,0457      ,0000     1,9378     2,8860
PERCSUST      ,4455      ,1188     3,7508      ,0002      ,2110      ,6801


*************************************************************************
OUTCOME VARIABLE:
 INTOOPAR

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,4424      ,1957      ,7010    19,7124     2,0000   162,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     1,1184      ,1942     5,7586      ,0000      ,7349     1,5020
PERCSUST      ,3844      ,0787     4,8839      ,0000      ,2290      ,5398
EMOTRUST      ,1200      ,0498     2,4095      ,0171      ,0217      ,2183
```
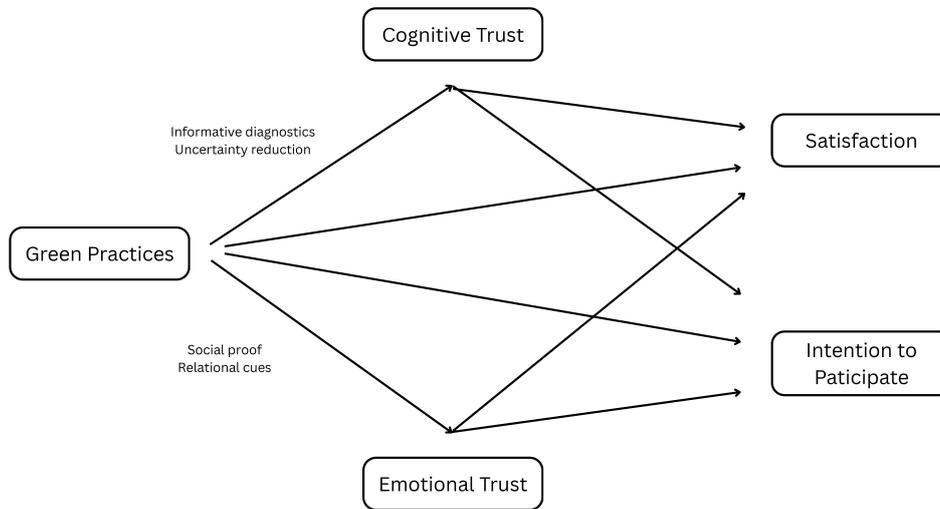
Appendix I: Emotional trust in the AI-Based Conversational Agent positively influences the relationship between green practices and intention to participate

9.5 Constructs

Appendix J: Construct Map

Construct	Measure
PERCSUSTAIN: Green Practices	The tennis tournament *would provide* information on caring for the environment.
	At the tournament, I *would be able to access* biodegradable and/or recyclable products.
	At the tournament, I *would be able to consume* organic products.
	At the tournament, *there would be* measures in place to efficiently use water and energy.
	The tournament *would promote* the recycling of waste.
	At the tournament, *there would be* containers to collect waste related to tennis practice.
PERCSATIF: Satisfaction	I *would be happy* with the experience I could have at this tennis tournament.
	I *would truly enjoy* attending this tennis tournament.
	I *would feel emotionally engaged* by the experiences I could have at this tennis tournament.
INTTOPAR: Intention to Participate	I *would feel* a sense of pleasure after participating in this tournament.
	I *would recommend* my friends and family attend this tournament.
	If I have the opportunity to attend this event, I *would definitely go.*
TRUSCOMP: Perceived Cognitive Trust in Competence	The AI-based conversational agent *would be an expert* in assessing sustainable initiatives.
	The AI agent *would have* good knowledge about sustainable initiatives.
TRUINTEG: Perceived Cognitive Trust in Integrity	The AI agent *would provide* unbiased sustainability recommendations.
	The AI agent *would be* honest.
	I *would conside* r this AI agent to be of integrity.
EMOTRUST: Perceived Emotional Trust	I *would feel secure* about relying on the AI agent for my decisions.
	I *would feel content* about relying on the AI agent for my decisions.
	I *would feel comfortable* about relying on the AI agent for my decisions.

Appendix K: Constructs and Measures

Initiative (input)	Process	Output	Outcome	CA integration
Travel footprint tracker	Report of the transport modes on apps	Data on CO2 emissions	Fans' awareness of the their travel impact	Provide low-carbon travel prompt and impacts' dashboard
Sustainable transport fleet	Use of electric vehicles solutions for players and fans	Lower transport emissions	Fans' perception of organizers' green initiatives	Inform on timetables, routes and green solutions
Renewable energy partnerships	Sponsorships and programs integrated into the event operations	Renewable energy use	Fans' perception of organizers' climate committment	Show the partneships and the avoided tournament's emissions
Reusable bottles and plastics	Distribution and refill points	Reduction of single-use plastic	Fans' change of everyday habits	Give statistics on plastic savings and maps of the distribution and refill points
Recycling bins	Smart bins and waste collection monitoring	Higher recycling and lower waste	More efficient waste management and higher fans' awareness	Guide fans' recycling chioces and share bins statistics
Sustainable materials	Use of eco equipment and surfaces	Reduction of materials impact	Fans' perception of organizers' green initiatives	Explain the products life-cycle
Green catering	Adoption of eco-friendly packaging and sustainable supply chains	Reeduction of food footprint	Sustainable consumption	Highlight green food options and the related supply chains

Appendix L: Implemented green practices and CA integration

9.6 Survey

Imagine you are attending a major outdoor tennis tournament designed with a strong focus on environmental sustainability. To help spectators better understand and engage with the tournament's green initiatives, a Conversational AI Agent has been introduced. This digital assistant is available via the tournament's app and info points, and it can answer your questions about the event's eco-friendly practices—such as waste management, energy and water conservation, and the availability of organic or recyclable products.

You can interact with the AI Agent at any time to receive personalized recommendations on how to make your visit more sustainable, locate eco-friendly services, or simply learn more about the tournament's efforts to protect the environment. The AI has been designed to be knowledgeable, transparent, and emotionally supportive throughout your experience.

Please answer the following questions based on how you would perceive or have perceived your experience with both the tournament's sustainable initiatives and the AI-based conversational assistant.

1. **DEMOGRAPHY**

Age (In years)
- 18-30
- 31-44
- 45-59
- Over 60

Gender
- Male
- Female
- Prefer not to say

Level of education
- High school diploma
- Bachelor's degree
- Master's degree
- PhD

Occupation
- Student
- Employee
- Self-employed

- Unemployed
- Retired

Geographical area

- Africa
- Asia
- Europe
- North America
- South America
- Oceania

Season attendance: how often do you attend tennis tournaments?

- Never
- 1 time per year
- 2-3 times per year
- 4-5 times per year
- More than 5 times per year

1. SUSTAINABILITY

Based on the scenario you just read, please indicate the extent to which you agree with the following statements about the tennis tournament's sustainable initiatives.

Green Practices

- The tennis tournament *would provide* information on caring for the environment.
- At the tournament, I *would be able to access* biodegradable and/or recyclable products.
- At the tournament, I *would be able to consume* organic products.
- At the tournament, *there would be* measures in place to efficiently use water and energy.
- The tournament *would promote* the recycling of waste.
- At the tournament, *there would be* containers to collect waste related to tennis practice.

Satisfaction

- I *would be happy* with the experience I could have at this tennis tournament.
- I *would truly enjoy* attending this tennis tournament.
- I *would feel emotionally engaged* by the experiences I could have at this tennis tournament.

Intention to Participate

- I *would feel* a sense of pleasure after participating in this tournament.
- I *would recommend* my friends and family attend this tournament.

- If I have the opportunity to attend this event, *I would definitely go*.

---

2. AI-BASED CONVERSATIONAL AGENT

Now, please consider your impressions of the AI-based conversational agent described in the scenario. Indicate your level of agreement with the following statements.

Perceived Cognitive Trust in Competence

- The AI-based conversational agent *would be an expert* in assessing sustainable initiatives.
- The AI agent *would have* good knowledge about sustainable initiatives.

Perceived Cognitive Trust in Integrity

- The AI agent *would provide* unbiased sustainability recommendations.
- The AI agent *would be* honest.
- I *would consider* this AI agent to be of integrity.

Perceived Emotional Trust

- I *would feel secure* about relying on the AI agent for my decisions.
- I *would feel content* about relying on the AI agent for my decisions.
- I *would feel comfortable* about relying on the AI agent for my decisions.