Capstone Thesis

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**To what Extent can Conference Organization
Become Environmentally Sustainable?**

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Abstract

Academic and professional conferences are a valuable setting for researchers to exchange their findings and improve their fields. Yet, with the long travels, high greenhouse gas emissions and an extensive use of resources, conferences prove to have significant impacts on the natural environment. Due to the unfolding climate crisis, the conference industry should put more attention towards transitioning to more sustainable practices. Areas which require most urgent attention include travel, catering and infrastructure. Based on a literature review of previous conferences and environmental policies, like the United Nation Sustainable Development Goals, I analyze ways in which those events could become more eco-friendly. Also, I recognize the importance of technological developments that the COVID-19 pandemic gave rise to. Key solutions include using low-emitting transportation, sustainable venues, eco-friendly catering methods, and enabling an online attendance setting, while highlighting the involvement of local resources and people across all of those sectors. However, due to the limited existing literature on this topic, this paper encourages further investigation in this field, by recommending scholars to extend existing findings and develop further practical solutions to enable the conference organization to become more environmentally sustainable.

1. Introduction

For many decades, conferences have involved academics and professionals who gather together to exchange ideas and findings about their studies. In recent years, the conference industry has been growing rapidly, as research shows, the "number of conferences worldwide more than doubled between the years 2000 to 2016, from 5,125 to 12,293" (Falk et al., 2018). Conferences engage a professional, scientific and academic community who are often involved in important decisions in their fields, which adds to the value and reach of sustainability measures introduced as part of the event. However, the organization of a conference produces high levels of greenhouse gas (GHG) emissions through international travels, unsustainable energy consumption methods and an exploitative use of resources. Therefore, with the industry growing, the environmental impacts are too (Mair et al., 2021). Due to the deteriorating climate conditions around the world, and the effects of the events industry, it is inevitable to reevaluate present practices. Lessons can be learned from the success and failures of past conferences, and sustainability frameworks for similar event sectors. Many promising innovations were developed during the COVID-19 pandemic, which began the extensive use of online and hybrid settings at congresses (Fraser et al., 2023). Conference organizers should recognize the alternative practices developed throughout time that can be implemented to improve the climate crisis. Given their authority in society, "researchers should lead by example and undertake actions to reduce the carbon footprint of their profession" (Desiere, 2015). Existing literature on efforts to make conferences more sustainable reveals a body of work focusing on singular aspects of the events sector, like catering, hotel and service infrastructure, destination attractiveness, or delegates' expectations. There is still little research done in the field of sustainable development of large-scale conferences in general. This raises the necessity for more future work in this direction. Sustainable entrepreneurship works in favor of doing so, which offers a new take on the way businesses should work in an environmentally-friendly way. My paper aims to contribute to filling this literature gap, and add to the already existing literature in the field of sustainable entrepreneurship. I will do so by answering the research question "to what extent can conference organization become environmentally sustainable?" in the context of large-scale international conferences (+1,000 participants). In the following paragraphs, I unpack the main terms in the question, namely 'conference organization', and 'environmental sustainability'. Next, I discuss the relevance of this research in the context of sustainable development, and outline the framework and aims of this paper.

Conference organization entails many steps to follow, and stakeholders to collaborate with. It begins with an event concept and managing the logistical aspects of its execution. This includes deciding on the event location, creating the programme, inviting speakers, as well as exhibitors and sponsors. The next steps include participant registration, and handling key practical aspects like catering, infrastructure and services (Fernandez-Zamudio et al., 2024). This network of partnerships is necessary for the conference organizers to successfully cooperate with all parties involved in order to satisfy the clients' expectations. Conference organization is a time-consuming, logistical process which requires a lot of planning and coordination. There are different types of conferences, some examples include: academic, commercial, developer, trade association or governmental conferences. This paper will focus specifically on academic and

scientific conferences. Nevertheless, conference organizers play a fundamental role in establishing sustainable practices at the events. The organizers must consider the client's needs and their attitudes towards present practices, and be tailored in a way to meet the community's requirements (Santos et al., 2022). This is especially important after implementing all steps of the organization process in practice, when the execution of the event becomes the most important point. This process is worthy of attention, since "scientific conferences are integral to all fields of study, providing learners of all ages with opportunities to improve their practices, resulting in advancements that may benefit the greater population" (Leochico et al., 2021). The first conference that received a sustainable certification, namely the EMAS certificate, was the COP 23 UN Climate Change conference. This achievement requires prior planning and incorporating sustainable practices like "waste separation, provision of climate friendly transport, and using reusable materials to construct temporary structures" into the conference organization process (ICLEI, 2022). Therefore, developing and improving the conference industry should be recognized as an increasingly important objective, because of its late adoption of the highly needed sustainable practices. The process must introduce changes in current organizational methods and consider the effects of decisions on the climate. In this paper, I analyze the ways in which some steps of conference organization could be improved to become more sustainable.

Sustainability is a concept, which has three main aspects; environmental, social and economic. As visible in Figure 1, the United Nations Sustainable Development Goals (UN SDGs) are distributed over the environmental, social, and economic aspects of life (Stockholm Resilience Center, 2016). This diagram, known as the SDGs "wedding cake" was designed by the Stockholm Resilience Centre (2016), and illustrates the multilevel division of the SSGs. As explained in the *Events and Sustainability* book by Holmes et al., (2015), "environmental sustainability – refers to the conservation and responsible management of natural resources by minimizing pollution and protecting the environment". Economic sustainability refers to improving the wellbeing and prosperity of society through sustainable economic activities, and social sustainability promotes inclusivity, equal rights and distribution of benefits (Holmes et al., 2015). The most accurate definition which captures sustainability's significance as a whole is from the United Nations Brundtland Commission Report when the term was coined in 1987, as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (UN, n.d.). Around that period, experts in the field stated that humanity is in a time when the environmental risks that people created "can no longer be limited locally, temporally or socially", due to the already exceeded planetary boundaries (University of Helsinki MOOC Center, n.d.). The need for sustainability has recently become a global necessity, because of the deteriorating climate conditions. We have already surpassed the limit of 1.5°C of global land-ocean temperature increase since pre-industrial levels that was decided upon during the 2015 Paris Agreement (UN, n.d.). According to the Intergovernmental Panel on Climate Change, greenhouse gas emissions, increase in temperature and the changes of the physical landscape are some examples of the negative consequences to which human's actions have contributed (IPCC, 1999). In 2015 the UN launched the 2030 Agenda including the 17 SDGs which consisted of targets like peace, justice, environmental protection, or industrial development in terms of nature preservation (UN, n.d.). The SDGs are now widely recognized

as guiding principles of improving different aspects of life, and sustainability has become a buzzword (Ioannou et al., 2021). However, so far the targets are not reached, and as the UN Chief declares, we are "halfway to 2030, world 'nowhere near' reaching Global Goals" (UN News, 2023). As research shows, the conferences industry is a significant contributor to the negative environmental impacts, and waste production (Bianchi, et al., 2022). The UN describes a 'sustainable event' as one which is "designed, organized and implemented in a way that minimizes potential negative impacts and leaves a beneficial legacy for the host community and all involved" (Santos et al., 2022). To ensure that, this paper discusses the current state of sustainability in the conference industry, and proposes changes to become less environmentally-heavy.
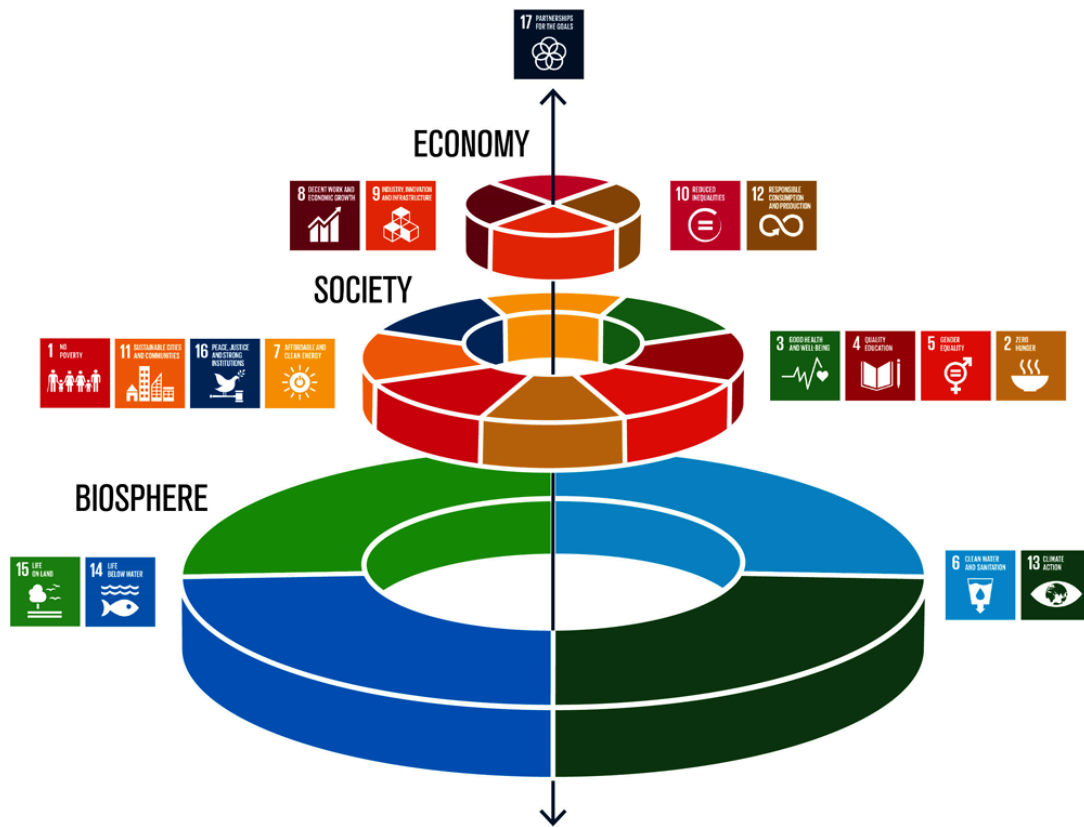

Figure 1: Distribution of SDGs over the environmental, social, and economic aspects of sustainability (Stockholm Resilience Center, 2016).

Sustainable entrepreneurship aims to make businesses and industries more ecologically friendly and socially responsible. As stated by the UN target *12.6 Importance of transparency and accountability*, "companies are increasingly being called on to show that they operate and make decisions in a responsible way" (GRI, 2019). This target encourages companies to share their data and be transparent, to mobilize them to choose just and fair resources. The events industry is considered to be inherently unsustainable, as it has a heavy impact on the environment through far-distance participant travel for short periods of time and with high organizational expenses (Mair et al., 2021). Yet, sustainable entrepreneurship offers an

approach which encourages implementing innovative solutions to businesses with the aim of balancing out the profit with the impacts on the climate and society (Muñoz et al., 2018). As visible in Figure 2, according to GreenComp, the European sustainability competence framework, the structure of human life is visualized with the environment as an omnipresent overlooking aspect of life, which narrows to the society, and then to the economy (Bianchi, et al., 2022). This indicates that actions made in one sphere of the diagram have an impact on other spheres too, and the environment is a boundary holding the other two in place. This therefore emphasizes the importance of putting sustainability 'on the agenda', and preserving nature, as it preserves us. This is also stressed by the Organisation for Economic Cooperation and Development, as "the interconnected nature of sustainable development calls for going beyond borders, whether they be geographical or institutional, to coordinate strategies and make good decisions" (OECD, 2008). This quote supports the meaning of Figure 2, raising the importance of the complex structural connections between the environment, society, and economy and how this should translate into international governance. Sustainable entrepreneurship encourages business to consider the potentially transcending consequences of their actions. "Economic growth generally correlates with overall improvements in quality of life (...), but this does not tell us how this growth is achieved; and who benefits or is left behind" (OECD, 2008). The purpose of this work is to investigate various methods to make conferences sustainable in a holistic way, revealing certain wrongdoings. This paper aims to promote just and sustainable business practices in the conference organization industry, and shed light on the environmental and connected social impacts of current practices.
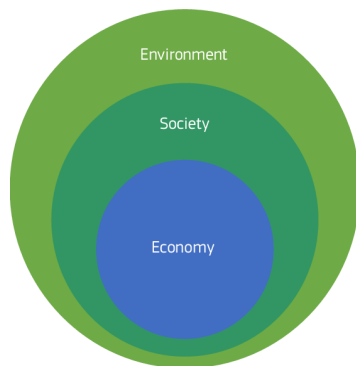

Figure 2: Interconnectedness of economy, society, and environment diagram (Bianchi, et al., 2022).

Year 2020 and the COVID-19 pandemic brought the necessity of re-imagining the functioning of businesses and industries worldwide. In that year, many markets experienced a financial drop in sales due to restrained possibilities of production and services (Zhou et al., 2020). COVID-19 limited people from traveling, which in the events industry resulted in the rise of virtual participation. The events industry adopted similar attendance methods as schools at that time, introducing online live streams, hybrid events for both physical and virtual guests, or recordings 'on-demand' (Fraser et al., 2023). The vast use of virtual and hybrid settings at conferences resolves the need for long-distance commuting from different parts of the world. A Nature journal study measured the daily emissions in the beginning of the pandemic in April 2020,

which lowered by 17% (Zhou et al., 2020). This statistic shows the results of limited transportation, which could similarly be expected from virtual or hybrid conferences. Such digital innovations play a significant role at many events nowadays, as they turn out to be more efficient. However, studies also find limitations of online participation methods, like high energy consumption for facilitating online attendance, and lower networking possibilities (Engelbrecht et al., 2022). In the following sections, I discuss the alternative solutions that were developed during the COVID-19 pandemic and their potential in more detail.

Even though thousands of people attend different types of conferences many times a year, this still remains to be an understudied topic (Pernecky et al., 2013). For today, most literature available on the topic of making conferences more sustainable focuses on a single aspect of the event, from catering and waste management, or technological advancements, to psychological analysis of delegates' behaviors. However, there is still little literature available that could guide conference organizers to become more eco-friendly in a holistic way. Prior literature on the conference organization process greatly focuses on economic and partly on socio-cultural impacts (Santos et al., 2022). In June 2012, the International Organization for Standardization, published a standard ISO 20121 guide on best practices to manage an event from a social, economic and environmental aspect. However, this was widely adopted in the global sports events and gatherings, and not the conference business, and not much further research has been done in this direction (UNDP, n.d.). This paper aims to promote implementing sustainable solutions in the conference industry, by contributing to filling this literature gap, as becoming more eco-friendly is a topic of utmost relevance in today's times. The conference industry is a sector which is a significant part of many researchers and decision-makers, as they foster many networking opportunities and offer a place to showcase their recent findings. According to Fellermann et al. (2019), congress participants attend an average of 3-4 conferences per year, 1-2 of which typically are intercontinental. As visible in Figure 3, almost 100% of participants responded to a survey on conference attendance that they attend at least 1 intercontinental conference a year, and 50-60% of respondents attend 1-2 conferences a year within their country or continent (Fellermann et al., 2019). With conferences occupying a significant part of researcher's time, and the current need for transitions to sustainable frameworks across all sectors, this paper adds to the lacking literature on making conferences more sustainable. To find an answer to the research question "*to what extent can conference organization become environmentally sustainable?*", I offer a review of literature and research conducted on environmental protection from the perspective of a conference organizer. To determine the extent*,* the paper is divided into 2 interlinked sections that answer the question. Firstly, I introduce different parts of congress organization and how they impact the natural environment. I argue that the three main components of congress organization which emit the most GHG and require further research are: travel, catering and infrastructure. I also discuss the technological developments that were brought during the COVID-19 pandemic, and its impacts on the relation of conferences with the environment. In the second part I propose solutions based on the earlier in-depth analysis that can be implemented in the event industry in the long-run which would help to achieve a more sustainable future of conference organization, and encourage further exploration of this topic.
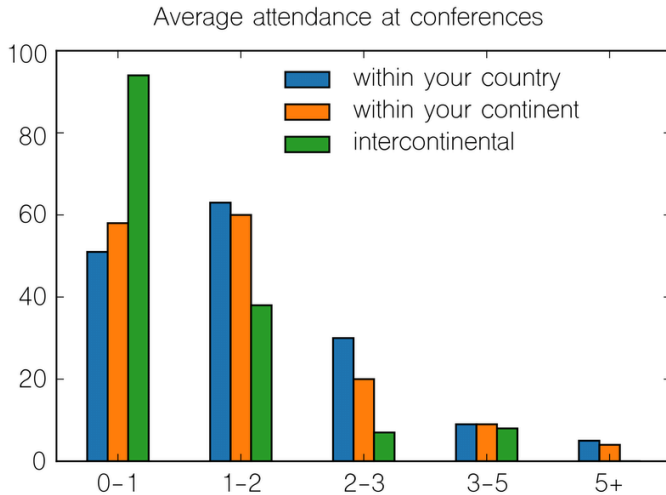
Figure 3: Average attendance at conferences per year (Fellermann et al., 2019).

2. Methodology

The methodology of this paper is based on a literature review, analyzing different conferences that happened in the last decades and their most significant aspects which are relevant for the environmental sustainability topic. I also use existing research published as a result of the changes brought by the unfolding threats of climate change, and the consequences of the COVID-19 pandemic. They serve as support for my thesis statement that those crises brought new opportunities to the conference industry, which could be used to reduce the environmental impacts of the events. Europe is home for most conferences happening around the world, and as shown in Figure 4, in 2011, it held 56% of the global congress distribution (Ficarelli et al., 2013). This trend is still visible nowadays (Statista, 2022). I focus on large-scale, international conferences, and I identify three most important elements of conference organization, i.e.: travel, catering, and infrastructure. This literature review allowed me to analyze differences and similarities in practices of different conferences. Throughout the paper I use the UN SDGs as reference points to evaluate the current state of the development achievements in regards to conference organization (UN, n.d.). I divide my analysis into 2 parts, first by analyzing the main components of conference organization which are most environmentally-heavy, i.e.: travel, catering, and infrastructure, and secondly, by discussing alternative solutions developed as a result of the COVID-19 pandemic. Lastly, I form recommendations and conclusions to keep in mind for conference organizers as part of further research in this field.
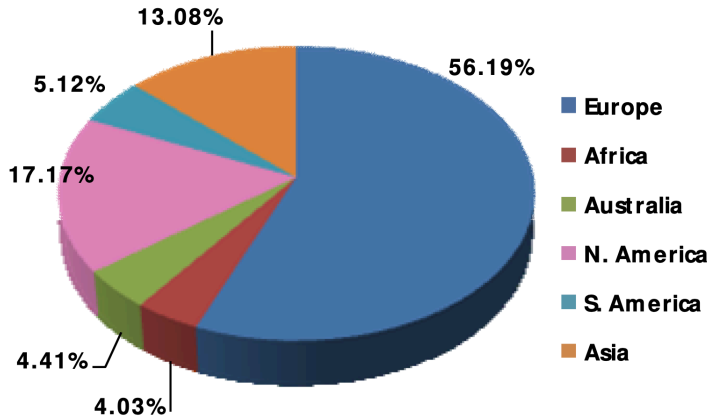
Figure 4: Global Congress Distribution in 2011 (Ficarelli et al., 2013).

3. Analysis

3.1 Components of Conference Organization

Conference organization consists of many elements, and involves cooperating with different stakeholders to manage a successful short-lived event with thousands of international visitors. In the process of conference organization, planning is the most important moment, as the outcome depends on the decisions made during the planning phase (Ficarelli et al., 2013). Research shows that the most fundamental components of conference organization are travel, catering, and infrastructure. As determined by the Convention Industry Council and the Events Industry Council, the sectors that conference organizers need to improve to become sustainable are: accommodation, audio-visual equipment, event communication, host destination, exhibits, catering, venue, meeting spaces and transportation (Amandeep et al., 2017). Those are the sectors which conference participants fuel the congress economy with the most (Ficarelli et al., 2013). However, those areas are simultaneously the ones emitting the most CO_2. PlanA, a company specializing in corporate carbon accounting, decarbonisation, and ESG reporting, measured a Scope 3 emissions breakdown of their events, on a scale from 0-500 kg of CO_2 emissions. As visible in Figure 5, the most significant parts of their conferences indeed include: catering, travel, infrastructure, logistics, energy and waste. The graph depicts that catering generates the most; catering ~400kg, travel ~150kg, logistics ~30kg, accommodation ~20kg, electricity and waste ~5kg (Plan A Academy, n.d.). Food and beverage consumption at a conference is a vital part of the event, which creates networking opportunities for delegates and adds an informal aspect to the event. The complex blend of work and leisure at a conference creates a unique experience for the participants, which makes the consumption of refreshments and food a valuable addition to the event (Lin et al., 2019). Travel encompasses the different means of transportation that the delegates and organizers have to use to reach the event location. Because of the international setting of large-scale conferences, transport of thousands of participants accounts for a major portion of the industry's pollution. Services and

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infrastructure also matter, availability of IT, accommodation, and touristic facilities (Fernandez-Zamudio et al., 2024). The COVID-19 pandemic was the spark for such technological innovations, which largely influenced the way events are made. In the below section I analyze each one of those components in detail based on a prior literature review, and determine how each factor could improve the sustainability of conference organization.
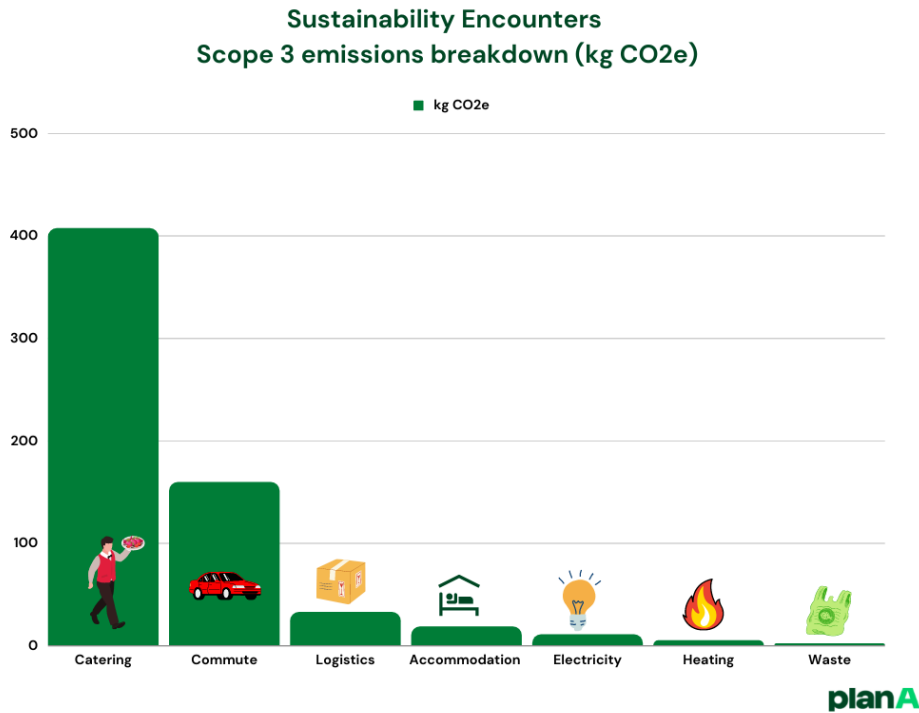

Figure 5: PlanA's event Scope 3 emissions breakdown (Plan A Academy, n.d.).

Travel

Participant travel is the most environmentally-heavy aspect of conference organization, therefore it requires primary attention. As large-scale, international conferences are organized in various business-touristic places in the world, they require far-distance travel from many attendees. Congress tourism falls within the broader category of business tourism, which is also defined as "the provision of facilities and services to the millions of delegates who annually attend meetings, congresses, exhibitions, business events, incentive travels and corporate hospitality" (Ficarelli et al., 2013). Other researchers coin this industry by the acronym of the MICE tourism, which stands for Meetings, Incentives, Conventions, and Exhibitions, and is largely similar to 'business tourism' (Fernandez-Zamudio et al., 2024). It is important to understand the nature of this type of travel, to be able to modify its particular elements while maintaining the delegate's satisfaction. From an anthropological perspective, a conference is an important event in the life of a delegate, as it is an opportunity to live within a semi-corporate setting for the duration of the conference. "Traveling provides people with opportunities to get rid of their identities in everyday life, entering the 'non-place', where all of them have similar

temporary identities (i.e. tourists) and are anonymous to each other" (Lin et al., 2019). What is more, conference travel is a commodity, as it has an exchanged value, like knowledge or networking, and it is only for a specific audience, "conference travel is a perk of being an academic". Not everyone can experience the luxury of attending a conference and using the offered services and facilities of this commodity (Nicolson, 2017). Delegates treat a conference as a trip combining holidays with work, which for sustainability is a beneficial aspect, as conferences merge the two trips into one. With this mindset and approach, delegates value comfort and high level of service because they consider the conference as something more than just a business trip. For this reason, delegates have different behaviors and attitudes during a conference, which they usually do not impersonate in their daily life (Lin et al., 2019). With participant travel being the largest carbon footprint emitter, but also an important social part of the conference, organizers must take delegate's feelings into consideration while implementing changes.

Furthermore, a considerable part of the conference's GHG emissions are generated by the transportation of the delegates. According to MCI, a global event organization agency, travel contributes almost 90% of all emissions generated in the process of the organization of the conference (MCI, 2022). This includes the different modes of transportation delegates chose to reach the event. In another research, Engelbrecht et al. (2022), studied 7 major European conferences in political science (ECPR), which reach up to 2,000 participants. Their findings conclude that "travel-induced carbon footprint of a single conference can amount to more than 2,000 tons of greenhouse gasses—as much as approximately 270 UK citizens emit in a whole year" (Engelbrecht et al., 2022). This highlights the significant environmental impact of conference-related travel and reinforces the need for more sustainable event practices. This is supported by other research, which finds that for a 3-day conference, an attendee generates 0.5 - 1.5 tonnes of CO_2 emissions, however to meet the UN Paris Agreement each person would have to emit 2.5 tonnes of CO_2 emissions a year by 2030 (Plan A Academy, 2020). That is roughly equal to the emissions generated by attending 2, 3-day long conferences. With such carbon intensive travels, there is little to no chance of improving the climate situation, that is why, the industry must decarbonise itself and find more sustainable practices.

Furthermore, the emissions per participant traveling to a conference depend on the means of transport they use. The detailed distribution of emissions of travel show that transport as a whole encompasses 24% of global CO_2 emissions (Ritchie et al., 2024). Studies find that the most environmentally-heavy way of travel is by plane, contributing almost 5% of all global GHG emissions (Leochico et al., 2021). This is also visible in the events industry, by being the highest polluting means of transport of all. As studies show, "presenters who can reach the conference venue in less than 5 hours using the street network would choose not to fly" (Jäckle, 2022). This is a viable policy of promoting more sustainable transport options, rather than the time-saving, yet heavily damaging for the environment choices. The possibility of traveling by low emitting means of transport to conferences is desirable, for example by using trains. Hosting cities for conferences which have a highly-developed network of trains or metro lines is faster to travel in, and pollutes much less than cars. An example of this can be noticed in cities like Hamburg, Germany, where conference participants can easily reach the venue using public transport

(Jäckle, 2022). Railway transport affects the environment positively, because of the reduced land use due to a high density of networks, and a lower production of GHG. A city which has a highly developed automobile infrastructure however, has an opposite effect on the environment, because of its widespread reach, and the high level of GHG emissions (Zornoza-Gallego, 2022). Promoting the use of low-emission transportation, such as trains, and selecting host cities with robust public transit systems is in line with SDG 11 *Sustainable Cities and Communities (UN, n.d.).* Given the high emissions related to delegate travel, it is important to consider the type of transport conference attendees use, in order to alleviate the environmental impacts of conference travel.

Catering

Catering is the second key component of conferences which may be modified to make the event have a lower impact on the environment. Catering is the stakeholders responsible for supplying the event with food and beverages (Chung et al., 2021). It falls under the HoReCa (Hotel, Restaurant, and Catering) sector of food production. Apart from its primary role which is feeding the delegates, it serves as a networking platform, where participants can interact in a more informal manner while enjoying their meals (Doppler et al., 2020). The food produced however, significantly contributes to the environmental impacts by its meat production, processed food, and wasted products, which need urgent mobilization for more sustainable measures. As stakeholders in the event industry, conference organizers have the right to demand catering companies to adopt practices that support environmental stewardship and public health, aligning with global goals for sustainable development and food security. Catering has a significant impact on the participants' conference experience, and therefore can be altered to positively contribute to the event (Doppler et al., 2020). Currently, it has considerable negative effects on the environment, contributing to GHG emissions, harmful agriculture and food waste, which influence human health. In the below section, I discuss those four aspects in more detail providing arguments for their significance in making conferences more sustainable.

What is served on the plate by the catering company is not only relevant for the people, but also for nature. With the unfolding dangers of global warming, considerations of the environmental consequences of food served have become a growing concern. The main contributor of emissions in the food industry is meat. Beef, lamb, and pork, among others, are environmentally harmful due to the necessary deforestation for the farming land for the animals, as well as the high production of methane emissions by livestock farms, which are harmful for the environment and the ozone layer. What is more, the animals are often put under immoral conditions on farms, because of the businesses' efficiency-oriented approach (Avesani et al., 2023). This is connected to agriculture and farming techniques, which account for a big part of the extensive land use, water shortages and agricultural exploitation (Fernandez-Zamudio et al., 2024). The farming land is often treated with chemical fertilizers and pesticides which damage the soil and surrounding nature. Researchers predict that between 2000 and 2050, livestock farming will double because of an increase in meat consumption and in global population (Kiers et al., 2008). Therefore, this calls for a necessity to modify the existing catering practices and introduce a more sustainable production and consumption of meat. As a German study states, "eating animal products has a substantial environmental impact on the value chain, mainly

because many of these products are lost somewhere in the supply chain" (Nemeth et al., 2019). Based on prior research, it is evident that catering should limit its animal consumption in general, specifically meat, and improve eco-friendly agriculture methods, considering its high negative effects on the land, animals, people and the supply chain.

The food that is lost in the supply chain or during consumption is another contributing factor to catering's negative environmental impacts. The discarded food influences use of resources, like freshwater, cropland, or fertilizers needed for waste management (Kummu et al., 2012). This is a big challenge for global politics due to the uneven distribution of food, as now from all produced goods, roughly 1/4 is lost globally in the supply chain (WFP, 2020). The supply chain is a network of all the parties involved in making a certain product and delivering it to its client. This is an important process, as the final outcome depends on the singular steps in this chain, similarly to a conference organization procedure. According to data, in 2021 food waste reached over 58 million tons (approximately 131 kg/person) in the European Union. A considerable portion of this waste is generated in the food services industry. In the Global North countries, waste tends to concentrate in the final consumption phase, where 12% of food waste is generated in the food service sector, including restaurants, bars, fast-food chains, and catering. This sector is the third largest generator of food waste in Europe, following households (53%) and food manufacturing and processing enterprises (19%). "A 3-day large corporate event could contribute around 3,480kg of waste to landfill. 1/3 of waste disposed during an event is recyclable" (MCI, 2022). With catering having such a big influence on the food consumption, food waste and other patterns in the events industry, it is important to work towards reducing those negative practices and raise awareness of its impacts.

At last, catering is a service for the people, therefore it is crucial to consider the health impacts of the food on its consumers. Agriculture is strongly connected to human health, as the way we treat the food on farms with enhancers and chemicals, influences us since we consume it. As Nemeth et al., (2019) state, "the nutritional value of food depends on agricultural processes and input factors (if something is missing or in surplus, diseases come up)". This is related to ultra-processed foods, which include food additives like colorants, synthetic aromas, and flavor enhancers which are greatly damaging for human health (Nemeth et al., 2019). Researchers estimate that by 2050, diseases and health problems related to climate change will only deteriorate and populations will be at high risks (IPCC, 1999). Additionally, the immense food waste generated by the conference industry contributes to the structural injustices relating to world hunger. As stated by the United Nations, the wasted food in the supply chain increases the food availability gap, as already "2 billion people in the world do not have regular access to safe, nutritious and sufficient food." The call for limiting global food waste was already decided in 2015, as the second of the 17 UN SDGs, 'Zero Hunger' calls for "achieving food security and improved nutrition and promoting sustainable agriculture" (UN, n.d.). Food security as formulated at the 1996 World Food Summit, is "when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (WorldBank, 2023). This relates to Goal 12 'Responsible Consumption and Production', which calls for collective action towards considering the source of our goods and its effects on the society, environment and economy (UN, n.d.). As

aforementioned research shows, the catering sector at conferences has significant impacts on food distribution and waste. In the face of a degrading poverty situation around the world, catering companies should change their approach to food, and consider the 'invisible' effects of their actions.

Infrastructure

Thirdly, infrastructure is a significant aspect of the conference which consists of the services and facilities in or around the venue which help in organizing the event. According to Ficarelli et al. (2013), the most important elements of the conference infrastructure include meeting areas, like hotels, conference rooms, exhibition halls, and audiovisual equipment, like sound systems, projectors and digital facilities. Research finds that a well-situated conference venue with a variety of hotels and restaurants in the surrounding area of the conference works as a strategic benefit (Ficarelli et al., 2013). As Nicolson (2017) claims, it may be beneficial to use the venue as a cultural attraction, however it should not dominate its primary purpose being the academic value of attending the conference (Nicolson, 2017). An example of this can be noticed in Spain, where there are many distinct services and attractions near congress centers. Costa del Sol for instance, has a geographic advantage for being in a favorable position for daily excursions to other cities of Andalusia during the delegate travel. This serves as an example that it is beneficial to organize conferences near touristic facilities. Spain is a country that is working towards having "smart cities" and owes a lot of its development in recent years to an increase of congress tourism. This led to a growth in infrastructures, new technologies and tourist equipment in other cities like Lleida in Catalonia (Ficarelli et al., 2013). As visible, choosing a strategically located venue not only enhances the logistical and academic aspects of a conference, but also leverages the surrounding community providing an enriching experience for the attendees.

Selection of a sustainable conference venue is another significant way of becoming more environmentally sustainable. The conference venue is the main location where the event takes place, most likely including the session and exhibition halls. Waste management, heating, electricity, available infrastructure and other facilities onsite are factors which are largely dependent on the venue. Oftentimes, the conference organizers do not have an impact on the decisions made in those directions by the venue company, however the practices and values of the host location do influence the conference overall, therefore organizers may choose which venues they prefer (Adrien, 2021). An environmentally-desirable infrastructure would incorporate energy-efficient designs, utilize renewable energy sources, and promote the use of nearby public transportation, all of which contribute to a lower carbon footprint for the event. According to the World Bank's Sustainable Infrastructure Action Plan 2009-11, a sustainable venue should help developing countries improve in the principal infrastructure sectors like transport, energy, and information and communication technologies (ICT), reduce resources, and focus on social, economic and environmental objectives (World Bank, 2008). Such guidelines are important to be implemented to expect positive environmental change and inspire delegates, as it has been found that conference guests behave much differently from their everyday life, and they do not consider the environmental effects of their actions as much as usual (Melissen et al., 2016). Yanamandra, and the University of Cambridge's Institute for

Sustainability Leadership (2020) support this claim, that "a simple "do no harm" approach to minimizing the negative environmental externalities of an infrastructure project or providing an environmental offset is not sufficient to ensure that it is sustainable" (Yanamandra et al., 2020). Selecting a sustainable conference venue is crucial for minimizing the event's environmental impact, but also for promoting broader sustainability goals among the visiting public.

Another crucial part of infrastructure in today's conferences are the information and communications technologies. Existing literature on conference organization before the COVID-19 pandemic, already found that ICT services are among the most important infrastructure elements for large-scale international conferences (Chiou, 2011). Conference organizers are confronted today with the fast developing technologies and therefore the accordingly high expectations of delegates. For instance, a fast internet connection has become an inseparable part of conference services and has shaped infrastructure in a way that allows for it. According to Ficarelli et al. (2013), 'connectivity' and 'presentation' are the key aspects of technological development in the events industry in modern days. ICT can strengthen the visibility of congresses and give more ease to delegates (Ficarelli et al., 2013). Connectivity is responsible for staying in touch with the outside world of the conference. During meetings, sessions, or negotiations, many delegates gather at the same time, and communication or research possibilities are necessary, so internet connectivity is a crucial aspect of a practical participant experience (Lin et al., 2019). Congress managers also find Wi-Fi and audiovisual streaming essential, as shown in a survey about perception of technologies at congresses. Majority of respondents thought that Wi-Fi connection can give more value to the event, especially if they want to localize the event, advertise and build information (Ficarelli et al., 2013). With the delegates' evolving expectations of technological advancements, it underscores the critical importance of ICT infrastructure in enhancing the success of large-scale international conferences.

3.2 COVID-19 Pandemic

Year 2020 and the COVID-19 pandemic brought the necessity of re-imagining the functioning of businesses and industries worldwide. In that year, many markets experienced a financial drop in sales due to restrained possibilities of production and services (Zhou et al., 2020). COVID-19 limited people from traveling, which in the events industry resulted in the rise of virtual participation. This forced many conferences to move online, and therefore eliminate the need for physical venues, travel, or accommodations, which considerably reduced the carbon footprint associated with large gatherings. However, some companies already used virtual meeting technology in the late 20th century, as a way to save time and reduce travel costs. Nevertheless, public conferences only started using virtual technology in 2020 (Fraser et al., 2023). The vast use of virtual and hybrid settings at conferences resolves the need for long-distance commuting from different parts of the world. A *Nature* journal study measured the daily emissions in the beginning of the pandemic in April 2020, which lowered by 17% (Quéré et al., 2020). This statistic shows the results of limited transportation, which could similarly be expected from virtual or hybrid conferences. As the lockdowns eased, many organizations

adopted hybrid conference models, combining in-person and virtual attendance (Engelbrecht et al., 2022). A primary aspect of modern conference digital facilities include online or hybrid presence possibilities. For conferences which count thousands of participants from all over the world, it is often important to facilitate an online setting. Virtual conferences are a viable alternative to reducing emissions through lowering the need for travel, which I explore in more detail in the below section.

Within the online conference settings there are many subsections and elements that are crucial for the participant experience of the conference and the sustainability discussion. An online conference is one which has a livestream with presentations in real-time, or has recorded presentations with live discussion, or recorded "on-demand" sessions. A hybrid one is one which can host delegates on-site, as well as online. The "on-demand" sessions are found to be the most effective way of holding conferences, thanks to its flexibility and the freedom of the delegate to watch it (Fraser et al., 2023). It has been proven that online conferences are more accessible for more participants, which encourages a wider range of international attendees. Organizers make the registration costs lower for online sessions, which adds to the wider accessibility value (Stefanoudis et al., 2021). A study based on a 950-people online conference, 53% agreed that a virtual meeting was more attractive than a real life one due to the more international and global reach (Raby et al., 2021). However, due to the international nature of such conferences, time zones are recognized to be a challenge for some participants. It is impossible to facilitate a perfect time for all, however organizers usually use the same time zone as the host, or the timezone of the region with the most delegates (Stefanoudis et al., 2021). What is more, as a survey of 170 congress attendee's feelings towards online conferences found, that most people appreciate online settings due to advantages of cost and time-efficiency, bigger reach and accessibility. The positive impact on the environment was voted upon by 31 people, which is not a high result (Fellermann et al., 2019). Although some participants do not consider the environmental impacts, this inclusivity promotes sharing sustainable practices by allowing everyone to attend the event online (GRI, 2019). Technology allows delegates to connect with fellow attendees via social media networks or online travel communities before the start of the conference. Online platforms and interactions can foster a faster acquaintance with another person thanks to the digital tools (Lin et al., 2019). The use of online platforms also led to an increased innovation in engagement and delegate participation. New digital interaction accommodating more participants than physical venues, often at a lower cost, increasing accessibility for attendees from around the world can be seen as a beneficial option for conference organizers.

What is more, thanks to an online audience at digital or hybrid conferences, the waste and emissions produced during the event are much smaller compared to physical conferences. This reduction is achieved through decreased travel-related emissions, lower consumption of physical resources such as paper and plastic, and minimal need for on-site energy and waste management services. It is estimated that, depending on the circumstances, on average a "video conferencing takes at most 7% of the energy/carbon of an in-person meeting" (Ong et al., 2014). Tao et al., (2021) confirm this percentage, by measuring that a virtual conference can decrease the GHG emissions by 94% and energy consumption by 90%" (Tao et al., 2021). This

statistic shows the immense reduction of emissions thanks to an online setting. A great part of this result is the benefit of lack of transport, which as estimated can increase the conference emissions by 250 to 530 times more carbon emissions than those from the online conference (Jäckle, 2022). However, one rising concern is the electricity consumption of a virtual conference which contributes to the emissions. Specifically, this depends on the geographical distribution of networks of renewable energy sources, as places with more developed renewable sources are more beneficial for the environment than those with more fossil-fuel based electricity power supplies. Nevertheless, as renewable energy is being developed worldwide, there is a promising potential for a gradual decrease in the environmental impacts associated with electricity production (Tao et al., 2021). As visible, the shift to digital or hybrid conferences significantly reduces waste and emissions compared to physical events, yet there are still more advancements in decreasing emissions and developing renewable energy sources for conferences needed.

However, the 'technological solution' will not replace the real presence of participants at conferences. Although online attendance is a great solution to reduce participant travel to conferences, the face-to-face events still prove to have a better result on the industry. Engelbrecht et al., (2022), who studied conference developments that occurred during the pandemic, found that physical presence, the "value of face-to-face," overrules virtual attendance. Online participation through virtual means cannot facilitate the possibility of having a human interaction with other delegates, which is a drawback of the digital facilities (Engelbrecht et al., 2022). Tourists pay more attention to strangers that they encounter during conferences and search for new acquaintances. To some extent, meeting like-minded strangers can be viewed as an attraction in itself for tourists (Lin et al., 2019). However, virtual meetings do not allow for this, due to the technological obstacles and social norms. Online interactions cannot facilitate serendipitous interactions, and do not show the body language, facial expressions, or actual tone of voice. What is more, in hybrid settings, the online attendance often limits the attendees on the other side of the screen. "Virtual attendees miss side conversations and are limited in how they can influence the course of a meeting. In-person interactions have a much higher 'social bandwidth' than virtual interactions" (Fraser et al., 2023). Also, some attendees still consider virtual meetings less attractive due to the more complicated access to the other delegates and their works (Raby et al., 2021). It is also seen as faulty due to the possible postponements or cancellations of virtual events (Ha et al., 2021). Since the trend of facilitating online conferences only began in 2020, this field requires further research and improvement of current tools and devices. Nowadays, a challenge for online or hybrid settings at events is the "unreliability of the technology" (Leochico et al., 2021). This should be a reason to advance research in this topic and improve the available technological services at conferences. Similarly, while virtual attendance offers a valuable alternative for limiting travel, the unique benefits of in-person interactions at conferences remain unmatched.

4. Solutions

As seen from the findings of existing research, the unfolding dangers of climate change require making businesses more sustainable. It is crucial for more companies and organizations to implement changes and contribute to preserving nature, because thanks to it we can exist. With problems such as the climate change crises, it is a collective necessity to alleviate this problem (Young, 2006). Therefore, we should collectively work towards improving the global climate situation and resolving global problems through choosing more sustainable options. To change people's behaviors, there needs to be a shift in perspective and understanding of the problem. The benefit of introducing sustainable practices at conferences, may significantly increase the reach and scope of its importance and methods, thanks to the scientific and academic audience of those events. Due to those research-oriented delegates, they may further investigate the topic of durable business solutions, and therefore increase the positive impact on the society, environment, and economy made by the conference organizers (Bianchi, et al., 2022). In the global context, congress tourism represents one of the fastest developing sectors which are growing in the tourism industry (Ficarelli et al., 2013). Following the fundamentals of sustainable entrepreneurship, companies need to operate around resolving problems they notice with innovative solutions. Having analyzed the key elements of conference organization in detail, the most important factors that dominate are: travel, catering, infrastructure, and an online participation setting. As research proves, conference organizers could implement a number of changes, like setting online participation, reducing meat options in catering, or supporting the local communities of the destination's region. Across all those sectors, using local based solutions appears to be a binding factor. Engaging local stakeholders strengthens the connection between the conference and the host destination, which can foster mutual benefits and promote sustainable practices. As research finds, "green meetings can infuse sustainable developments into environment, education and community creating a win-win relation between commercial activities and environment" (Chiou, 2011). In the below section, I provide recommendations for implementing sustainable solutions based on the earlier analysis of the main components of conference organization.

Delegate travel being the most harmful aspect of conference organization, conferences are encouraged to find sustainable solutions to diminishing the emissions. Reaching the event venue by plane contributes the most carbon emissions from all means of transport, therefore organizers should work around using long-distance transportation as the only way of participating in a conference (Fernandez-Zamudio et al., 2024). Choosing a host destination which is strategically located near transit centers, public transport services and other facilities simplifying reaching the venue, proves to reduce the GHG emissions. Also, using low-emission transportation, like trains, and selecting host cities with well-developed public transit systems, also benefits the environment and society (Jäckle, 2022). A solution that Desiere (2015) suggests, is to reduce the carbon footprint of conferences, by 'localizing' the event. Inviting attendees for a physical conference from the same continent as the event location, while participants from other continents join online, would significantly reduce emissions. Welcoming delegates from the surrounding regions in person and the ones from more distant countries to

participate virtually, while promoting traveling by train, could reduce the conference organization by even 20% (Desiere, 2015). However, it must be noted that people perceive conference delegations as business trips combined with leisure and socializing, and so the overall experience is an important aspect for them (Lin et al., 2019). This perspective on conferences reveals an important underlying aspect of the meaning of congress travel for international participants. The work-leisure nature of the conference trip creates an opportunity for the delegates to experience this '2 in 1' package. Conference organizers could take advantage of this concept and try to enhance both aspects and embrace combining both of them at the same time. In result, this resolves the participants' need to travel twice for 2 separate trips, but rather offers an opportunity to spend an enjoyable time at a work trip. This could be also promoted by developing certain recreational activities into the conference that would add to the entertaining experience. This can be noticed at conferences like the SCDMlive, where each year the organizers come up with a different theme, engaging the delegates to join the initiative. This is done by offering sunset runs, morning yoga sessions, or organizing beach clean-ups (SCDM, n.d.). Such side-events are a valuable addition to the overall conference. However, such opportunities are only available while participating in the conference on-site, which raises the benefits and disadvantages of both. Online participation methods would decrease the travel needed, as it would be possible to attend the conference online from anywhere, just with a laptop (Fraser et al., 2023). In the following paragraphs, I discuss the potential online setting solutions in more detail. Overall, there are several options of sustainable travel solutions, which conference organizers can use to significantly reduce the environmental impact of delegate travel, while enhancing their overall experience.

According to prior research, catering is another contributing aspect on the environmental impact of conferences. The biggest challenges of catering at conferences include meat production, harmful agricultural practices, and finally the wasted food from the event. Literature suggests a few alternative methods for more sustainable practices at conference catering. Firstly, reducing meat from meals proves to significantly diminish the GHG emissions of food production. "The same amount of nutrients produced from plants generate 26–48% fewer pollutants, and have significantly less environmental impacts than meat or dairy products" (Nemeth et al., 2019). This supports the claim that plant-based nutrient sources are a viable alternative for reducing environmental harm, while keeping the meals healthy. There are examples of places which integrate sustainable catering methods in their businesses already, like the research-led medical university, Karolinska Institute in Sweden, that replaced unhealthy snacks served at their conferences, like candy and processed sandwiches, with fruits, vegetables, nuts, and sandwiches with lean meat. The changed menu cost roughly the same as the highly-processed prior menu, but generated much less emissions and was healthier (Avesani et al., 2023). Researchers also propose implementing international cuisines as guiding principles for creating more sustainable menus. For instance, food typical for the Mediterranean diet "is considered to be the most sustainable cuisine" (Nemeth et al., 2019). The 'fruits, vegetables and lean meat' is an exemplary diet for people, and generates much less emissions than serving meaty and highly-intensive farming products (Kiers et al., 2008). This does not only refer to the Mediterranean countries, but many cultures around the world embrace eating time as a principle aspect of the day, highlighting the importance of healthy food consumption. At international

conferences, the vast variety of nationalities should inspire conference organizers for finding more sustainable solutions within the people themselves. Diet is a complex choice which is influenced by lifestyle and culture (Nemeth et al., 2019). Embracing plant-based and culturally diverse dietary options not only significantly reduces greenhouse gas emissions but also enhances the nutritional quality of meals, providing a sustainable and health-oriented approach to catering at conferences.

Furthermore, lowering the environmental impacts of catering could also be achieved through local resourcing of the products. This reduces transportation emissions, supports local economies, and ensures fresher, seasonal ingredients that contribute to a more sustainable food system (Lopez et al., 2020). This could be observed in practice at the Glasgow COP26, where the organizers sourced at least 95% of their catering from the UK, and 80% was locally and seasonally grown, and found to have had considerable reductions in emissions. Another example of an alternative food sourcing can be noticed from the ICLEI World Congress 2022 in Malmö, Sweden. The organizers hired catering in the form of local food trucks which were considered to be the most tasty, friendly and sustainable (ICLEI, 2022). Such creative and entertaining initiatives can encourage congress members to participate actively in the destination. An enriching experience in the local culture of the conference can positively impact the delegates, and benefit the host destination too, by motivating the tourists to engage with the community. Involving local stakeholders can improve the local economy, and create partnerships between conference organizers and the local suppliers (Falk et al., 2018). "The support and commitment of the host country/city is crucial, especially when they are contributing to the event" (ICLEI, 2022). Also, locally sourced food does not require chemical additives or preservatives, as thanks to the close proximity it can be easily transported to the event location, therefore it can also use sustainable farming techniques (Nemeth et al., 2019). This allows for more suitable quantities of food to be produced and served, as it would not have to be imported on a large scale. This would in result diminish the food waste at conferences, by managing it in a more responsible manner. In case of leftover food, conference organizers could collaborate with food donation services or homeless shelters to maximize the use of the produce (Avesani et al., 2023). This would allow the leftover produce to be given back to the society. Prioritizing local sourcing of catering products not only reduces transportation emissions and supports local economies but also ensures seasonal ingredients that contribute to a more sustainable food system.

Next, to ensure the sustainability of conferences, organizers must carefully consider the sustainability aspect of the used infrastructure. Selecting a conference venue is an important choice for the event's environmental impacts. This may be decided upon by taking into account the sustainable practices or sustainability certifications of the venue. Those could include using renewable energy sources, local goods, and being centered in a location easy to access by public transport or alternative transportation (bike, walking). What is more, the integration of modern technologies is a crucial part of today's infrastructure facilities and services (UNDP, n.d.). Internet connectivity, audio-visual devices or an online audience, are all beneficial factors for ensuring a sustainable venue. Some researchers recognize organizing conferences at university conference centers as a sustainable option. This has been an evolving method since

2015, however still is not widely used. An 'on-campus' conference adds an academic and scientific value to the conference, by highlighting the education and research-driven aim of the event. What is more, this turns out to be a more cost effective way of conference organization than in a professional venue. "By hosting their annual meetings and conventions at university conference centers, meeting planners can save 10-15% of the total costs" (Samuel et al., 2021). In order to reduce long distance travel and its emissions, increase the conference's reach and inclusivity, as well as reduce the materials of resources, conference organizers should facilitate some form of an online participation setting.

Changes introduced by the COVID-19 pandemic can have lasting effects, encouraging a more thoughtful and sustainable approach to organizing professional gatherings in the future. The COVID-19 pandemic significantly altered the scene for conferences, creating opportunities to make these events more accessible. It benefits the participants by being time, cost efficient, and more easily accessible (Stefanoudis et al., 2021). The organizers benefit from the virtual meetings for similar reasons, and facilitating an online audience nowadays is widely available which should reduce costs and resources used during the event (Chiou, 2011). However, current studies show both positive as well as negative outcomes from the virtual conference attendance (Leochico et al., 2021). From an environmental perspective, the limited emissions from reduced travel are a desirable effect, and researchers suggest that companies should "consider delivering virtual noncommercial scientific meetings to replace established small-, to medium-sized real-world meetings" (Raby et al., 2021). Carbon emissions that can be reduced through lack of transport at online conferences can even reach 75%, and it reduces the overall energy/carbon cost of physical conferences by 27% (Ong et al., 2014). From a social perspective, online participation will not substitute physical attendance. It is difficult to compare the ad hoc in-person encounters and valuable interactions, which online events cannot facilitate with the virtual settings. The dilemma comes with the struggle to balance out the social and environmental aspects and decide on the best options for both. The most effective conference practices found include hybrid settings, which offer a digital environment, while embracing the physical participation at the event (Stefanoudis et al., 2021). This requires more advancements in innovative technologies to facilitate smooth conference attendance with a merged physical and online audience. Nevertheless, the global crisis helped in using alternative ways of making high-level international conference organization more sustainable, and we should take advantage of those opportunities.

Conclusion

In conclusion, this paper analyzed the major aspects of conference organization which have a play in the industry's transitioning to becoming more sustainable. Due to the conferences' environmental impacts in a time of an unfolding global climate crisis, it must be of the industry's intention and aim to attempt to alleviate this problem. As prior research states, conference organization is inherently unsustainable, however in order to change this, this paper analyzed the sectors that need the most urgent attention, and offered conference organizers possible interventions. To answer the research question of this paper based on the earlier analysis of existing literature on this topic, conference organization can become sustainable to a high extent, if proposed recommendations are embraced in practice. Implementing changes can not only improve and preserve the environment, but also elevate the socio-cultural value of the events and benefit the organizers. The environmentally dominating parts of the conference organization include travel, catering, and infrastructure. Those areas have potential for mitigating the environmental impacts and enhancing sustainability. The case study of the effects of the COVID-19 pandemic on the conference industry, revealed tempting solutions and potential practices that can be continued to be used to reach a more sustainable future. The recommendations of this paper are tailored for large-scale international conferences, but other parties can also benefit from the contribution of this work in the events, as well as the sustainability field. However, this study contains a few limitations, due to a limited time-frame and the possible scope of this research. I only focus on large scale international scientific and academic conferences, which limits my conclusions to only such specific events. The results therefore call for more research and recommendations for local events to discover the extent to which smaller conferences can incorporate sustainable measures in the organization.

Future Research
Due to the limitations of this paper, further researchers could extend the investigations in this field and continue developing theoretical and practical solutions. Transforming conferences to being more environmentally sustainable is still an understudied topic, and little research is available that focuses on the whole organization process, rather than particular aspects of it. The recommendations that I developed include using more eco-friendly transportation means, introducing more sustainable practices in catering, considering the venue's sustainability measures, and balancing an online and on-site attendance option. Those are based on the 4 main aspects of conferences which are most environmentally heavy, and dominate in the existing literature on this topic. Additional decision-making efforts based on sustainability guidelines are necessary to lead companies and allow organizers to implement feasible changes in their fields. This is a call to further action in this direction, recognizing the importance of sustainable development.

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