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Article

The Contribution of the FIFA World Cup and the Olympic Games to Green Economy

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Abstract: This paper focuses on the contribution of mega events onto the development of a green economy at the event host location and discusses how to measure it. The promises of organizers usually are very ambitious but the question remains as to how realistic these claims are. This question will be addressed in three sections by using methods that are primarily analytical and critical rather than an empirical collection of data. The environmental sustainability of mega sport events is discussed and then a framework is developed to capture the green legacy and the basis for building up a green economy in all its dimensions. The main contribution mega events can make to developing a green economy at the host city will be explained. Furthermore, the paper seeks to explain why promises made during the bidding process on the environmental sustainability are often not met when it comes to the preparation for the event. The current obstacles to producing "Green Games" and building up a green economy are presented enlightened, ranging from financial shortcomings to a lack of serious environmental interest on the part of the organizers. In conclusion, it will be shown that mega events encourage the development of a green economy by their signaling power and educational opportunities.

Keywords: mega events; signaling; environmental legacy; green economy; IOC; FIFA

1. Introduction

One of the big challenges for cities/nations hosting mega events like the FIFA World Cup or the Olympic Games is to find new ways to improve their performance not only in economic and social terms but also in terms of the environment. Bearing in mind the positive media reports on sustainability of the London 2012 Olympic Games, concerns on much less environmental

consciousness arise when observing Russia and South Korea (Olympic Winter Games Sochi 2014, Pyengchang 2018), or Qatar (FIFA Football World Cup 2022). Mega events are often considered as "footloose industries", in that their organizations mobilize considerable resources in the short term but then disappear, leaving long-term consequences. In other words, they come to a place with a need for resources and then disappear. While event organizers predominantly focus on the event with little emphasis on the environmental footprint, it is the government that is left with the task of ensuring sustainability and a green economy. Kandeh Yumkella, Director General of UNIDO (United Nations Industrial Development Organization), claims exactly this by saying that "[t]he global green economy has become a reality but world governments must do more to ensure its success" [1]. This call is supported by the United Nations Environment Program (UNEP), using a working definition of a green economy as one that "results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" ([2], p. 16). Karadakis and Kaplanidou [3] investigated the Vancouver 2010 Olympic Winter Games and found that "environmental legacies ranked the highest in terms of importance for the residents" ([3], p. 252) suggesting that local residents are also concerned about environmental legacies.

The research question for this paper is: How realistic is it to expect that mega events can contribute to a green legacy and develop a green economy at the event host location?

The paper is structured as follows. The starting point is a brief overview of the literature in regards to the environment and mega events (2). The methodology used for this research is explained in (3). In Section 4, I discuss the growing environmental awareness of the International Sport Governing Bodies (ISGB) and event hosts. A systematic framework will be developed in Section 5 to record the complex environmental changes by remodelling the legacy framework from Preuss [4] and using anecdotal evidence for illustration. The new contribution of this paper is presented in Section 6 where "signaling" and "education" are identified as the main influences towards developing a green economy in the host destination. The paper will conclude in (7) with a presentation of action which could be taken in order to transform the promises from candidates made during a bidding stage into legacy outcomes fulfilment.

2. Literature Review

Scholarly literature on developing a green economy through mega events is scarce although there are some references to the environment in regards to legacy (see Leopkey, Parent [5], p. 438). This paper contributes a framework to the literature that does exist and provides some explanations for the shortcomings in the development of a green economy. The following review will provide an overview of the discussions in the literature on the topic of mega events and environment. The body of literature examining sustainability and mega events has been growing ([6], p. 6).

The United Nations Conference on Environment and Development [7] resulted in increasing international attention to the issue of the environment and event hosting. Environmental sensitivity of major spectacles such as the Olympics, World Cups, and large international conferences is now increasingly common. DaCosta [8,9] was the first scholar to discuss this relationship with some depth. He, in particular, stressed ethical responsibility regarding the organization of mega events. Regarding winter sports, Kaspar [10] was one of the first to investigate the environmental awareness and

development of major events and he did so by examining the Olympic Winter Games in Lillehammer 1994. Türk *et al.* [11] also focused on winter sport events but only in regards to sport facilities. The Sydney 2000 Olympic Games, which became the first "Green Games" gave rise to many publications, notably the collection edited by Cashman and Hughes [12] who give detailed information on the environmental challenges and outcome of the Sydney 2000 Olympics. Beyer [13] investigated the capacity of the Beijing 2008 "Green Games" to catalyse sustainable development reforms. Her study examines the effectiveness of Beijing"s ambitious Olympic Action Plan and provides solutions to key environmental problems. Kaplanidou [14] focused on the environment and its contribution to increasing the quality of life. Collins *et al.* [15,16] developed the topic further and tried to quantify and analyze the environmental impacts of a major sport event. They utilized "Ecological Footprint analysis" and "Environmental Input-Output modelling", and highlighted the substantial environmental impact associated with visitor travel. The significant environmental impact is something that event organizers tend to shy away from. However, the frameworks used by Collins *et al.* [15] have also been criticized in academic discourse such as by Ferng [17].

In regards to FIFA Football World Cups, there is also not much literature on development of a green economy. In Germany, the Ministry for Environment and the German Olympic Sport Association carried out a comprehensive study of sport events and the green economy [18]. Dolles & Söderman [19] analyzed the "green goal" program established at the FIFA World Cup 2006, in Germany. However, Fitschen [20] asks whether such past mega events have been environment-friendly, genuinely "green" games or only a "greenwashing" exercise.

As shown later one major opportunity for events to help in developing a green economy is through signaling. Signaling is well described in literature though it is used in many fields such as in information economics [21–24], business and marketing [25,26], anthropology, biology and evolutionary science [27–32], and sociology [33–35]. With regard to the green economy, and for this paper, two signaling theories are of interest. One parallels the reduction of information asymmetry as used in Spence's principal-agent theory [24]. The other draws attention to the "costly signaling" theory developed in particular in anthropology and sociology. Not much research is available regarding "costly signaling" through mega sport events. Clausen [36] first mentioned a kind of event signaling as a strategy for using cultural events to signal information about a place. Kurscheidt [37,38], Preuss [39], and Preuss & Alfs [40] investigated sport-event signaling in greater detail, which will be discussed later. Garcia [41] also focused on Olympic Games signaling, but only indirectly on the production of cultural symbolic capital.

3. Methodological and Theoretical Bases

This paper is based on a mixed method approach using methods that are primarily analytical and critical rather than empirical. It has to be distinguished from mainstream empirical approaches in research papers. The main method used for this paper is hermeneutics. It aims to investigate how environmental issues gained importance in mega event history. Hermeneutics is the study of the interpretation of texts [42]. To be able to interpret the text, the interpreter needs knowledge about the context of the topic researched (the research field) as well as the psychology or political intention of the speaker respective author. The idea is that the interpreters' understanding of the text as a whole is

established by reference to the individual parts but also *vice versa*. The challenge for this paper is that neither the whole context on green economy nor any individual information (on action taken regarding environmental issues) can be understood without reference to one another.

I gained insight on in environmental issues during the bidding process and the preparation for mega events by being involved in the bidding for Olympic Games (Prague 2016, Budapest 2012, Innsbruck 2014, Frankfurt 2012, Munich 2018, Graubünden 2022) and the FIFA football World Cup (Qatar 2022).

By using deductive analysis techniques, the legacy framework from Preuss [4] was used to identify the complex environmental changes of mega sport events on the host destination. The existing framework was refined by adding a new dimension which enables a systematic analysis of event related environmental changes.

To derive conclusions and management implications, I leave hermeneutics in section 6 of this paper and use methods of "games theory" and information economics and "New Institutional Economics". These help to explain strategic interdependencies of decision situations of organizers ([43], p. 42). In "game theory" one distinguishes "cooperative" and "non-cooperative" situations. Non-cooperative "game theory" deals largely with how rational organizations interact with one another in an effort to achieve their own goals. In addition, the argument of this paper is based on principal-agent theory [24] which is a part of "New Institutional Economics".

4. The Growth of Environmental Awareness in Planning for Mega Events

Preuss [44] used rational choice theory to explain the factors that ISGBs focus on when deciding which city or country has delivered the best bid to stage the next mega event. Decision making in this regards is not a simple matter. The fast pace of life puts pressure on the board members of ISGBs to learn from the critiques of previous Games. For example, in an effort to avoid a repetition of the financial crises of the Montreal 1976 Games, the International Olympic Committee (IOC) removed the "amateur" paragraph from its Olympic Charter, thus, paving the way for commercialization of the Olympic Movement. The resulting focus on obtaining money for the Movement led the IOC to neglect cultural events, the environment [45], the Olympic values, and the athletes. However, the balance began to be restored in 1994, when IOC president Juan Antonio Samaranch specifically stated that the IOC considered environment and culture to be pillars of its future work ([46], pp. 251–254; [47], p. 1884). Today the IOC is aware of these pillars, having taken note of criticism of the environmental damage that resulted from the Olympic Winter Games in Albertville 1992 ([13], p. 427; [48]). Despite some debate about widespread environmental damage caused by the Lillehammer Games in 1994 (although the event organizers had focused on environmental conservation), these Games set the stage for the creation of the "green" Olympics [49,50]. In addition, the 1993 IOC members' choice of Sydney for the 2000 Games may have been based on the concept of "Green Games", which has been a benchmark for all Olympic Games since. The Lillehammer and Sydney Games marked the start of the IOC's environmental programs.

Even though talk about environmental issues among the organizers had already started "on the occasion of the 1932 games in Lake Placid […], environmental issues became increasingly important […] for Sapporo 1972 and Lake Placid 1980, albeit without the IOC taking any notable or

direct action" ([47], p. 1897). However, it was only in 1996 that the environmental paragraph was added to the Olympic Charter and became a central consideration in the IOC's development plans, selection and evaluation of event host cities as well as promotional activities [51]. Taking into consideration the decisions adopted in 1992 by the Earth Summit in Rio de Janeiro regarding Agenda 21 (a plan of action to be taken by organizations of the United Nations System, governments, and major groups in order to protect the environment), the Olympic Movement decided to establish its own Agenda 21 [52]. Adopted by the IOC Session in 1999, the aim of this Agenda was to encourage its members to participate actively in sustainable development. In announcing its bid for the 2008 Olympics, Beijing chose a "Green Olympics" theme to indicate that hosting the Olympic Games would serve as a catalyst for environmental improvements and sustainable development ([53], p. 275; [54], p. 174; [55]).

In the light of what has been achieved in the 20 years since Albertville 1992, it is clear that the IOC has done pioneering work, such as insisting that environmental objectives be included in the obligations for hosting nations. The result has been an increase in experience and expertise in the policy set up during the bidding stage. However, the monitoring of the host nation's efforts is far from perfect.

To identify the challenges faced by a green economy when organising mega events we need to look at the status quo. The Vancouver Organizing Committee (VANOC) was the first Organizing Committee ever to create a Sustainability Department. For VANOC, sustainability meant managing the social, economic, and environmental impacts and opportunities of the Vancouver 2010 Olympic Games to create lasting benefits, both locally and globally [56]. To achieve this, VANOC established a set of sustainability performance objectives. London 2012 followed this route. The Organizing Committee (LOCOG) produced the "London 2012 Sustainability Framework", setting out directions for itself and its partners on how to address sustainability according to priority themes ([50], p. 4). LOCOG tried to satisfy the twin requirements of avoiding or reducing negative environmental impacts and, where this was not possible, offsetting them with appropriate environmental benefits ([57], pp. 69–89). The IOC included environmental issues in its Charter. The role of the IOC is "to encourage and support a responsible concern for environmental issues, to promote sustainable development in sport and to require that the Olympic Games are held accordingly" ([58], p. 15). However, as will be argued later, it is governments that should embrace the task of actively monitoring and controlling the environmental sustainability of the event. It stands to reason that the overall development of a host nation determines the ability and desire realize environmental guidelines and promises. The government should control whether the organizing committees follow their bid promises.

A similar development can be seen at FIFA. This ISGB has encouraged local organizing committees (LOCs) regarding environmental protection only since 2005 when the German LOC launched the Green Goal environmental program for the 2006 FIFA World Cup (see Dolles & Söderman, [19] for the concept, [59]). Long after the IOC's 1999 inclusion of environmental matters in its Charter, FIFA gave assurance of its future commitment to the environment by deciding to include environmental protection in its bidding agreements. However, this will only come into force with the bidding process for the FIFA World Cups in 2018 and 2022. Table 1 shows the information requested from candidates on what plans had been made to avoid, reduce, and offset the negative environmental impacts of hosting the FIFA World Cup in comparison to the Olympic Games.

Table 1. Bid requirements of FIFA and International Olympic Committee (IOC) regarding environmental issues ([60]; [61], pp. 59, 69–70).

FIFA for 2018/2022	IOC for 2020
• A comprehensive environmental assessment of staging the FIFA World Cup, • Systematic integration of the environment into management structures, • Composition and integration of an Environmental Advisory Board, • Outreach program for stakeholder consultation, • Measurable objectives in six core topics of water, waste, energy, transportation, procurement and climate change, and • Planned activities to minimize the adverse environmental effects.	• Venue planning to support the concept of sustainable development as it applies to the Olympic Games in general, and to venues specifically (e.g., use of permanent or temporary structures, and environmentally sensitive materials, systems, and impacts), • Protected or environmentally sensitive areas, • Potential natural risks on the ambient air quality and quality of drinking water, • Details of any Games-specific environmental actions you plan on implementing, outlining how those actions fit in with overall city and region environmental and sustainable development strategies, and • A brief assessment of the environmental impacts and legacies of staging the Olympic Games in your city/region.

FIFA only focus is on reducing the footprint of the event. In contrast, the IOC tries to reduce the long-term environmental harm by requesting "a concept of sustainable development" and "assessment of the environmental impacts and legacies". However, it also is obvious that FIFA expects a higher degree of management participation in regards to environmental action. FIFA requires an integration of the environment in the "management structures", an implementation of an "Environmental Advisory Board" and wants "stakeholder consultation". In contrast the IOC does not directly request any environmental management structures.

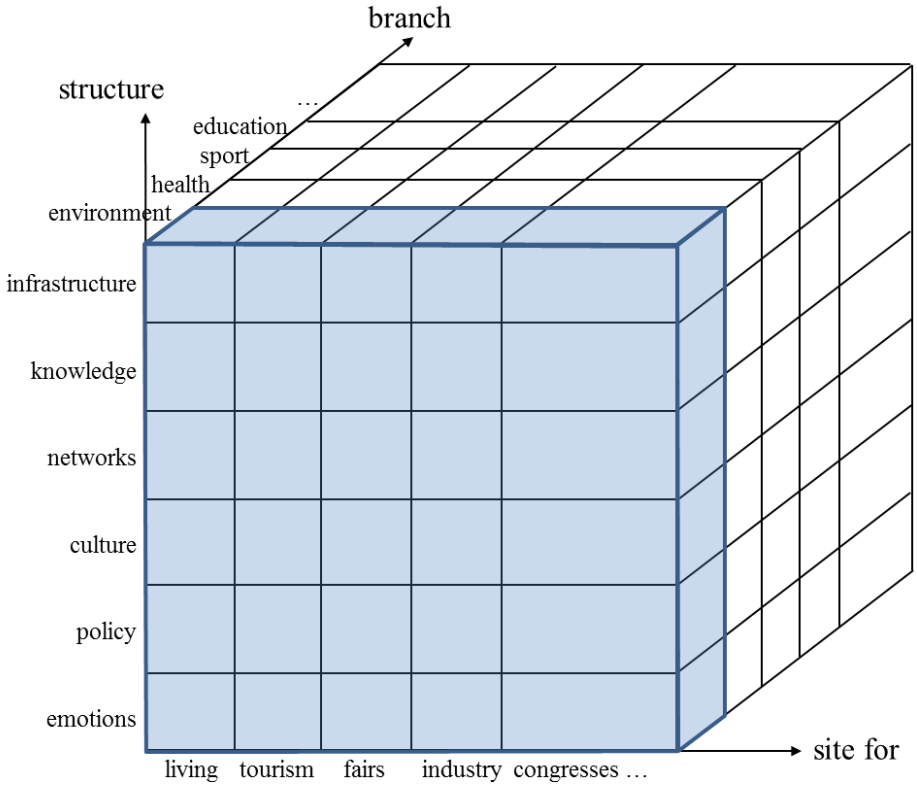
5. The Green Legacy of Mega Events

This section will develop a systematic analysis framework of green legacy. It will focus on the development of environmental related location factors, or, in other words, how a mega event can transform the host destination towards a green economy. The following example shall outline the different perspective which this paper takes. Death [62] points out that the 2010 South African FIFA World Cup "sought to develop a 'Green Goal 2010' program in order to mitigate some of the environmental impacts of the event and to secure a positive social, economic and environmental legacy". He says that these mitigation efforts were "relatively piecemeal" but nevertheless "some innovative and significant projects were implemented, ranging from waste management and recycling, to biodiversity protection and city beautification, to public transport upgrades and energy efficiency measures at the stadiums" ([62], p. 99). In this paper the idea is to focus rather on the "change of location factors" to develop a green economy than to non-systematically mention environmental efforts. The green legacy as seen from the perspective of this paper (using the example above) would be the measurement of the gained "knowledge" on how to recycle, how to educate people about recycling, and how to increase public transport efficiency. Another green legacy is the change of the

location factor "infrastructure" in terms of new stadiums and transport systems constructed on high ecological standards.

Figure 1 illustrates the extension of the legacy framework from Preuss [4], which was developed to systematically evaluate event legacy. Using the basic idea a new dimension called "branch" is added. The "branch" in this case is the environment. In the following the framework is focusing on "green legacy" only (grey part in Figure 1). The figure graphically illustrates three dimensions (structure, branch, site) which can be used to systematically detect the legacy of an event.

Figure 1. Dimensions of event legacy.



Dimension 1 is the *structure*. Each event requires its own particular structure and cities differ in the structures they have available. The environmental impact of an event will therefore be different for each host. The wording "structure" is used to refer to anything in an environment that is affected or produced by preparing and staging an event, whether tangible (e.g., infrastructure) or intangible (e.g., emotions) (see Table 2). During the preparation for the event, much structure is changed (e.g., an intangible structure such as event know-how is built up). During the event, the momentum of the mega event creates "emotions". To build up sustainable infrastructure and ensure a positive green legacy, optional measures should be embedded in the obligatory event preparation which will be discussed later.

Dimension 2 in Figure 1 is the *branch*. There are a variety of branches or industries that can be analysed regarding legacy. Here we focus on the branch "environment". Other studies may analyse the event legacy of branches "sport", "health", "politics", *etc.*

Dimension 3 in Figure 1 is the *site* that gets changed. After the event, some of the event structure will vanish, though most of it will continue to exist, whether briefly or for a longer period. These

change the "location factors" and transform a city to a better place for living, tourists, or industry. For example the change of location factors (*dimension structure*) related to environment (*dimension branch*) may increase the quality of life (*dimension site*).

Six types of event affected structures (axis of ordinate in Figure 1) are usually preserved after the event. All of them have relevance for developing the green economy. Five of them—infrastructure, knowledge, networks, policy, and culture—are developed almost as a matter of course through the preparation for the mega event, while emotions depend on the momentum the event develops ([63], pp. 92–97). Each of these six event structures transforms the location factors of a host city making it a better destination (abscissa in Figure 1). In this paper the focus will be on those changes of "green" structures (grey area in Figure 1), which change the host city into a better site for living, industry, tourists, fairs, conferences, and events under the branch "environment". For example a better site for living would be created by public transportation systems with less air pollution or a better site for industry would be created by workers receiving education on energy conservation.

Table 2. Types of structure created by an event regarding the branch "environment".

Dimension "Structure"	Explanation for Branch "environment"
Infrastructure	Sport venues, Olympic villages, FIFA team base hotels, media centres, *etc.* are usually constructed following environmental guidelines, along with green infrastructure that is added to a city, such as new/extended parks or planting additional trees. Beijing 2008 changed to low emission heating and relocated polluting industry to the outskirts. Often cities improve their metro systems, set up light rail and traffic control systems to reduce emission from cars. If the land used for a sport venue was previously a brownfield site or if ecological diversity is threatened at a newly used location, at least some environmental necessary projects are initiated. All these changes are usually observed closely by environmental watchdog organisations such as Greenpeace, and the media directs attention to reporting on environmental damage caused by mega events. However, time pressure and cost overruns encourage last-minute changes with the result that environmental obligations are relaxed or even overlooked ([64], p. 131).
Knowledge	Environmental know-how can be distinguished in two kinds: Firstly, the intensive use of engineering and architecture to construct the new facilities in the most environment-friendly way may lead to the development of new green engineering techniques. Secondly best practice at highly recognized events can be used as an educational tool. Using public transport or managing waste sensibly during the event allows people to experience environmental theory in action. Events provide examples and material that schools can use to educate pupils about the value of protecting the environment such as in Vancouver 2010 where the Inuit were used to illustrate how they used to live their lives in harmony with the natural world.
Networks	During the bidding and preparation for the event the organizers are in exchange with environmental organisations. It is in the organisers' interest to meet their expectations and to avoid overly critical media coverage. A working relationship develops and often grows during this time.
Culture	In case the educational efforts regarding environmental sensitivity are successful a cultural change in habits may occur. However, a single event can only be a piece in the process of cultural change. But this structure also includes sport as a cultural good. The ISGB put pressure on their recognized federations to comply their statues with environmental sensitivity. National federations have to follow these rules which may end up in a process to make sports environmental more sustainable.

Table 2 ***Cont.***

Dimension "Structure"	Explanation for Branch "environment"
Policy	The bidding, preparation and staging of mega events requires many policy changes or new policies due to making the event fit into the local/national political environment. New structures require regulations to be managed (e.g., new policy for running new sport venues). Existing policies may become updated.
Emotions	Mega sporting events arouse many emotions. These emotions may be connected with national pride, identity with indigenous people, social inclusion, or a feeling of environmental responsibility. In case the mega event creates green motives, emotions can trigger people to take part in the green movement before the event. Teachers may be motivated to use the event as an educational tool, and politicians to aim for high environmental sustainability or citizens to take up a healthier lifestyle ([50], p. 4).

The structures introduced in Table 2 should not overlap. Therefore, "image" is taken out of the framework from Preuss [4] because it is a mix of "emotion" and "knowledge". The structures should be non-overlapping and in combination with dimension 2 (branches) double counting can be avoided. Doing so, a sport legacy can be evaluated by looking at sport infrastructure, sport knowledge, sport networks, sport culture, sport policies, and sport emotions. A green legacy will have to consider environmental infrastructure, environmental knowledge, environmental networks, environmental culture, environmental policies, and environmental emotions.

6. How Mega Events Can Contribute to the Green Economy

Organizing committees have one express purpose and that is to organize the sporting events. By doing so, they may change many existing structures in the community (Table 2) but they may use the energy generated by the upcoming event to piggy-back optional activities. The content of the "green" programs varies widely between host cities and events, but all bid and host cities of mega events strive to create an impressive program. These range from flagship projects which are highly visible (e.g., carbon neutrality) to less visible projects such as use of solar energy for public transport.

However, it is also a fact that the event itself, intervenes in the local community in a way that harms the environment and which catalyses opposition from green organizations. But they likely overlook that almost all alternative activities of the community also would (negatively) impact the environment. Nonetheless, at stake here is, not only the impact at the time the event takes place (e.g., extra water use during the event), but the power the event has to change existing structures and patterns towards a green economy (e.g., permanent better water recycling at public sport buildings). The energy brought into a local community by an event can change existing patterns, policies, and infrastructural conditions and change the structure (Table 2) repetitive. E.g., the Olympics in Beijing 2008 made people think about pollution and supported change such as from coal heating to gas heating and the introduction of recycling systems or in Athens 2004 people were educated to use public transportation. Without the pressure of an upcoming mega event, these transformations and educative lessons may not have occurred or may have occurred much later. Therefore, this paper is not about the event activity and environment but about the legacy from the changed conditions after an event (e.g., motivation of people to act green, knowledge of students about environment (education), or infrastructure changes such as public transportation offers, park construction, pedestrian zones).

In general the contribution that mega events can make to develop a green economy should not be overestimated. However, past events have proven that there can be green legacies, such as rehabilitated and revitalized sites, greater environmental awareness and better environmental policies and practices. They can further encourage and facilitate strong environmental action through the educational value of demonstration projects. This will be discussed in Section 6.1. The biggest advantage of a mega event is its visibility, in other words its branding and signaling potential, which can inspire greater environmental awareness and awake a stronger commitment of politicians to support building up green economy (Section 6.2).

6.1. Education as a Means to Grow the Green Economy

The sustainable greening of industries is encouraged through supporting local communities that are educated about the environmental, social and economic benefits of resource efficiency, cleaner production, and responsible life cycle analysis. The overall great interest of the population in mega events provides significant opportunities for education and training for resource efficiency and environmental sensitivity.

Often the events are used as content for the development of educational material for schools. In addition, events provide many good examples for the local population to learn different environmental behaviour or at least to start thinking about "greener" behaviour. These outcomes vary from country to country. While, for example, in Germany, event bidding create environmental debates through the media and community activities (Munich Olympic Winter Games Bid 2018), in Russia (Football World Cup 2018), the goal has primarily been that of new environmental sensitivity. Therefore, making recycling containers widely visible and accessible or providing convenient public transport that is simpler and cheaper to use than a car are just two examples of how mega events can start to educate people. In this regards it was one of the legacy targets in London 2012 to encourage "residents adopting good environmental practices such as recycling and waste reduction" ([65], p. 18).

Educative material based on mega events can be integrated into different stages of education and training to instil the idea of using resources efficiently. The following are some examples:

- Primary and secondary school education: National sport organizations can provide educational material to teach children about protecting the environment and using resources efficiently. During this phase, children absorb a set of values that will enable them to make informed choices in the future that can improve the environment and the quality of their lives. For example, the Beijing 2008 Organizing Committee launched educational campaigns for sustainable development and strived to raise the nation's environmental awareness.
- Technical and vocational education: This training phase plays a crucial role in providing knowledge, methods, and tools to event volunteers and also the staff and contractors in organizing committees. The training can help them to design and implement practical solutions for resource efficiency and other environmental behaviour.

Education in regards to mega events provides an opportunity for governments, ISGB, and Organizing Committees to accentuate the need for a green economy. Integrating the topic of resource efficiency into educational curricula and vocational training centres is an "optional structure" set up by

the host city and nation [4]. It adds extra costs to general education expenditure by the government, which is the main obstacle to using a mega event as a stimulus for environmental education.

6.2. How the Green Industry Can Benefit from Event Signaling

The boost that mega events can give to the green economy through the "free promotion" effect [63,66,67] is considered in this section. The worldwide interest in the Games and the media "hype" that surrounds them means that the Olympics offer an important public relations opportunity [39]. For example, a sensitive and sustainable event and sophisticated green technology can affect the way the host city and country are seen. They can be seen as a business attempting to increase awareness of opportunities available for investors, such as newly developed green technology (for example stadium cooling systems in Qatar or Dioxin remediation techniques in Sydney). They can also be seen as a tourist destination trying to attract visitors looking for sustainable sites or eco-tourism. Other things that mega events can signal are sustainable planning skills, sensitivity to the environment and biodiversity, and advanced ability to invent green technology.

The special focus on signaling through a mega (sport) event is not new. Signaling theory is contained in principal-agent theory [22]. A fundamental aspect of the principal-agent theory is the information asymmetry between a better-informed agent and a less-informed principal. The principal does not know the exact intention and motivation of the agent. The agent and principal have an overall common aim, but the agent wants to maximize not only the principal's benefit but his own as well. As the principal is unaware of hidden characteristics of the agent before the selection (here on ISGB member voting for a future host), he may choose an agent with suboptimal characteristics. This management problem is called "adverse selection". In order to decrease the information asymmetry, "signaling", "screening", or "self-selection" can be used. In the signaling approach, the agent (bidding committee) can send signals to convey otherwise hardly observable qualities and information to the principal and thereby lower the probability of an adverse selection. However, it is beneficial for the agent to produce a signal only if the advantage of the production of signals is greater than the costs of producing it, while the opposite is true for the competitors [68], which is also called a separating equilibrium [24]. In other words, a bid committee can plan to provide an environmental project that is relatively easy to deliver but it only positions itself better if the other bid candidates cannot easily copy the environmental program. The prize is a better position in the bid race, while the costs are the efforts to be made to deliver the program.

The bid candidates in 2018 Munich and Pyeongchang were competitors. Munich developed an expensive and innovative program to gain advantage in the bidding process [69], while Pyeongchang focused more on IOC expectations (see Table 1) and added some additional components (see Bodet, Lacassagne [55] regarding this strategy). If one reads Table 3 displaying the presentation of the IOC bid city evaluation commission, the programs look competitive. Therefore Munich lost the advantage of its signal.

The table illustrates the promises made by the two bid committees. Thus, a mega event organizer (the agent) puts out information about the environmental efforts being made in the host city by promoting its green programs. The principal does not need to be an IOC member only, it could also be a tourist looking for a destination with green sensitivity, or a green industry looking for a location to set up business.

Table 3. Promises of Candidates bidding to stage the 2018 Olympic Winter Games ([70], pp. 27, 97)

Munich Olympic Winter Games 2018	Pyeongchang Olympic Winter Games 2018
The environment and sustainability program is centred on "Flagship 18: A Concept for Sustainability Benchmarks for the Winter Games", developed by the bid with 18 projects in regard to climate change, protection of the natural environment, sustainable sport and regional development and environmental education and awareness. This program would be mostly government-funded with a budget of USD 117 million. There would be "green space" legacies and a proposed "Centre for Sustainability" would be created in Garmisch-Partenkirchen to provide a foundation for environmental and sustainability education and research in the region. A total of only 1.3 hectares of forest would be removed for venue alteration and construction for the Games, with at least that amount of space replanted in compensation. The bid committee stated that no protected areas would be damaged. The plan for a carbon-neutral Games, based on energy saving, renewable energy and carbon offsets, takes into account all Games-related air travel (including spectators). The bid committee's aim is for the Munich Olympic Village to achieve the Gold standard under the "German Sustainable Building Council" certification system, which focuses on minimizing energy consumption, and to reduce energy consumption by 30% in existing venues to be renovated (and used for different sports) for a 2018 Games. All major construction projects—including competition and non-competition venues—would be subject to strong German legislation in regard to energy consumption and standards for new buildings and renovations and the use of renewable energy. The bid committee stated that all new venues would be supplied with 100% green energy from renewable sources.	The Environmental Management Plan focuses on six areas of action: climate change (a carbon neutral Games and the generation of renewable energy), ecosystem protection, water conservation, achieving zero waste (recycling, and minimizing waste), sustainable regional development, and the promotion of environmental awareness. Games plans fit into a regional energy development plan, as well as into national, regional and local environmental protection plans, and there would be strong governmental involvement in the delivery of environmental actions. There would be an innovative Games program in regard to energy sustainability and efficiency. All new competition venues would be designed to achieve net-zero greenhouse gas emissions and Pyeongchang 2018 aims to achieve LEED platinum level certification (a USA based system of energy and water conservation, waste stream management, along with utilizing sustainable materials and methods). At some venues, sustainable building certification objectives of LEED platinum status could be difficult to achieve. 73% of electrical energy demands for the Games would be met by existing renewable energy facilities, and the aim is that a planned additional wind generation plant would help to achieve 100% renewable energy for the Games. The "Special Act" to be passed for the Games includes provisions in regard to carbon-neutrality and renewable energy self-sufficiency. Existing competition venues will be upgraded to reduce their carbon emissions by more than 90%. The bid committee stated that 94 hectares of forest, including 63 hectares of forest area would be removed for the development of new venues. Tree planting would compensate for this, with planting of twice the area lost. Although the development of the Jungbong venue is likely to have a significant site impact, the Commission received assurances that the forest preservation area would remain protected.

Another kind of signaling can also be observed in regards to mega events [40]. The so-called "costly signaling" theory was first introduced by Veblen [35] and is also called the "handicap principle". This theory describes the use of signals which are very costly and therefore hard to imitate because of the inherent signaling costs of reliably conveying information about the sender. The sender has to invest significantly in these signals and the less useful they are to the sender the more trustworthy they are. Veblen [35] explains costly signaling by saying that conspicuous expenditure is a strategic action designed to build up and accumulate symbolic capital. Therefore, the highest profits in symbolic capital can be obtained when someone engages in conspicuous consumption and lavish spending, thus reliably demonstrating lack of interest in material acquisition. In similar fashion, mega events often use green flagship projects, e.g., for their new eco-friendly stadiums (in Qatar) and solar transport systems. The technology is quite expensive and often overdone in comparison to other environmental infrastructure investments. However, the mega event infrastructure are showcases and therefore excellent for creating green symbolic capital.

7. Conclusion—Challenges to Be Met to Transform Promise into Actuality

The concept of sustainability to be spread through mega events is an idea worth exploring. As these events are high profile, very visible, and attract worldwide attention, the organizers cannot afford to ignore widely shared concerns about sustainability. The attractiveness of a mega event obviously presents opportunities for strengthening the green economy, but there are obstacles to be overcome. In the following, 3 steps will be presented to illustrate how mega events can contribute developing a green economy as legacy.

The first step towards greener events was taken when the ISGBs included environmental protection in their Charters. This bound bid cities to include issues of sustainability and environmental protection in their bidding procedure. By making this a requirement, the ISGBs put the candidates under a lot of pressure, in effect putting them in a "prisoner's dilemma". A candidate cannot afford not to offer a good environmental program for the 2018 Olympic Winter Games (see Table 3). The choice of each candidate is to offer "optional" measures to meet the green expectations of the IOC members who are going to vote [55]. If a candidate decides not to offer a well-developed green program, this is a disadvantage. The Nash equilibrium here is of a prisoner's dilemma type, because each candidate offers expensive flagship projects but does not gain an advantage in their bid. For example, the Olympic Winter Games 2018 bid procedure in actuality put the candidates in a competition to offer the best possible environmental program.

There is also pressure from the public, who have a stake in these programs too because their living conditions will be directly affected by the event [14]. The media also become involved, putting further pressure on the candidates. To make a successful bid, the candidates find themselves obliged to offer an exceptional environmental program, and it becomes a competition of strategies to gain a better bid position through adding unique projects into the environmental program (so called "rat race", see Akerlof [21]). Overall, this competitive situation has very positive implications for the green economy. Both the ISGBs and the public have the power to force the candidates to give high priority to this issue. In turn, the candidates can use the high level of interest for their signaling strategies.

The second step in promoting a green economy is to ensure that the promises made by the successful candidate are fulfilled. Once the Games have been awarded to a particular host, the ISGBs and the winning organizers set out jointly to organize a great sport event. These two bodies can be seen as "footloose industries"—they are looking only at the event and their true interest in sustainability is limited. Media reports on cost overruns are usual for mega events, not only because estimations of costs are strategically set low during the bidding process, but also because it is easy to underestimate the complexity of the job and the real costs (the "winner's curse"). Political interests may attempt to use the mega event to piggy-back additional projects which adds to cost overruns. There is also the problem of time pressure. The need to deliver an extraordinary event in a short time often puts the environmental concerns on the back burner. The flagship green projects keep getting signaled, but the smaller ones get side-lined. This explains the ambivalent behaviour of some environmental organizers—on the one hand supporting the projects related to the event and on the other hand fighting against the implementation of other event related projects. For example at Sydney 2000 (marketed as "Green Games"), two community-based environmental groups, Greenpeace and Green Games Watch 2000, were in regular fights over environmental sustainability with the OCA (the governmental construction organization) but had better relations with the Organizing Committee ([71], p. 157), which tried to avoid bad press. In London 2012 BioRegional and WWF [72] developed a scorecard including 76 promises according to London 2012. Headline themes were compared with "One Planet Living principles" and the two stages of the London 2012 program, the "Games" and the "Legacy". The scorecard shows great differences on what should be delivered and what was delivered. However, the process of transforming a city into an Olympic city encourages the various environmental organizations to communicate, evaluate and even to create networks in order to work together with the city and the Organizing Committee [69].

The following are some ways to ensure that the promises are fulfilled and do not get side-lined:

(1). The organizers of green events must appreciate the value of environmental assets and must regulate the changes brought about by the events to translate this value into market incentives. It is therefore important that the ISGBs, in cooperation with the national politicians, ensure that the cost of environmental losses is included in the estimate of the overall cost of the event. This would be a first step to making the overall cost of the event visible. This step was undertaken by the IOC which established the OGI (Olympic Games Impact) measurement framework as an obligation to each organising committee. Collins *et al.* [15] suggest a quantitative impact assessment of selected environmental externalities connected with visitation at sporting events. These result in the wish that the ISGBs need to set up a more efficient system of self-regulation to ensure that promises made during the bidding process are fulfilled. Increased transparency is needed, and also penalties for failure to carry out promises.

(2). The governments of host nations must take responsibility for controlling the long-term use of venues and also all green activities involved in the event. In other words, the responsibility must be moved from a temporary organizing committee to a permanent government body. This will prevent the "moral hazard" situation of an organizing committee (agent) towards the public (principal).

(3). The green organizations can increase their pressure on the organizers by using the media "hype" around the event. In Sydney 2000 for example, "watch dog" organizations have put outside pressure on organizers to carry out the plans they announced during the bidding process. The frequent media reports on environmental issues can also help to educate the host populations to get a greater sensitivity towards the environment. However, in newly industrialized countries and the BRICS it is still common that the environment is less a point of concern than the economy. This can be observed by the low environmental concern in Sochi 2014 (Russia) or in Brazil during their preparation for the FIFA Football World Cup 2014. However, green organizations have the potential to ensure that local and international public also put pressure on the organizers.

(4). Worldwide media and ISGBs should combine to publicize the bid candidates' promises and thus increase the political pressure on the organizers to fulfil them. The pressure is greatest if it is related to flagship projects which can be used by the host to build up symbolic capital. For example, the Qatar 2022 organizing committee promised to cool their World Cup Stadium carbon-free. The worldwide media have aroused expectations about the development of green cooling technology. Although Qatar has enough fossil gas resources to cool the stadiums easily and cheaply, they are now obliged to develop a new green technology. This will build up symbolic capital if successfully implemented but attract criticism if they fail. In other words, investing money in something that is not strictly necessary builds up symbolic capital and signals that the nation is taking care of the environment. In the case of Qatar, the FIFA World Cup has inspired investment in green cooling technology and cooling systems for buildings. This could be very interesting for countries with a desert-like climate—thus, not only creating symbolic capital for Qatar, but also leaving a global environmental legacy and business opportunity.

The third step towards a green economy would be to use the interest in a mega event to develop educational curricula. The IOC and the UNEP signed a Cooperative Agreement in 1994 to conduct various activities to raise awareness and educate people about environmental matters in sport. Since then, UNEP has also developed working relationships with Olympic organizing committees in Athens (2004), Turin (2006), Beijing (2008), and Vancouver (2010) to promote environmental issues in the Games ([50], pp. 1–2). The IOC itself supports educational programs by organizing regional seminars in cooperation with Olympic Solidarity, whose mission is to plan, organize and oversee support programs for National Olympic Committees. Similar activities are done by FIFA.

However, these impacts would not reach enough of the population. Therefore, school curricula could be developed. Mega events can help to develop an understanding of green growth, explaining its short-term and long-term objectives, and covering four priority environmental challenges: biodiversity (e.g., the Golden Bell Frog project in Sydney 2000) and ecosystem services (e.g., remediation of brownfields); climate change (e.g., use of public transport or carbon-free cooling systems for stadiums, buses and vending machines); sustainable materials management (waste management systems at venues); and sustainable use of natural resources (e.g., the ice rink for Vancouver 2010), including forests (planting millions of trees) and water (use of rain water in stadiums). All these activities can be used to produce educational material to sensitize the next generation.

Although the ISGBs were late in starting to adopt environmental guidelines and include them in their bidding processes, they now exploit their position as monopolies and demand sustainable planning and green events from the competitors. Bid cities and nations find themselves in a "rat race" [21] trying to offer the best possible environmental programs. However, after winning a bid, the situation is that cost overruns and time pressure inevitably reduce the urgency of environmental and sustainable thinking. The "footloose industries", after all, do not themselves particularly need to take care of the environment and green economy. Thus, sustainable thinking has to be controlled by the government or organizations that are responsible for the aftermath of the particular mega event.

Further research and management applications should focus on how the governmental organizations can take over further responsibility. This is essential for ensuring the well-being of current and future generations.

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