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The achievement of sustainability and legacies by the host cities of the Summer Olympiads, 2012-2024

Stephen Essex and Renata Latuf de Oliveira Sanchez

Dr Stephen Essex,
School of Geography, Earth and Environmental Sciences,
University of Plymouth, Drake Circus, Plymouth, PL4 8AA, Devon, UK.
(Tel: 01752-585980; email: s.essex@plymouth.ac.uk)
Corresponding author

Dr Renata Latuf de Oliveira Sanchez,
Formerly School of Architecture and Urban Planning,
University of São Paulo, Rua Maranhão, 88, São Paulo, Brazil.
(email: renata_los@hotmail.com)

Short bios:
Dr Stephen Essex is Associate Professor (Reader) in Human Geography at the School of Geography, Earth and Environmental Science, University of Plymouth (UK). His teaching and research focuses on urban planning, especially the infrastructural implications of the Olympic Games and post-war reconstruction planning.

Renata Latuf de Oliveira Sanchez is a practicing architect and urbanist in Brazil. Her doctorate thesis at the University of São Paulo focused on the urban legacy of the Rio 2016 Olympic Games and was funded by the São Paulo Research Foundation. She has been a visiting scholar at KADK, Copenhagen, the University of Plymouth and KTH Stockholm. She currently works as an architect at the Urban Mobility Secretariat in Limeira and a lecturer in architecture and urbanism at Centro Universitário Salesiano de São Paulo in Americana.

Abstract

Since the emergence of the concept of sustainable development, the Olympic Games have become a vehicle to demonstrate and promote the principles and practices of sustainability. The aim of this paper is to explain and evaluate how the application of sustainable development in the context of the Summer Olympic Games has evolved. Two processes have been influential in this change: first, the institutional expectations of the International Olympic Committee have encouraged greater responsibility towards the creation of legacies by potential host cities through the IOC Charter, the Olympic Agenda 2020, and the Olympic Agenda 2020+5; and second, the context and inventiveness of host cities has created new perspectives on sustainability to secure the event and raise its global profile. This paper will focus on the sustainability benchmarks established in London 2012 and evaluate whether these have been continued or extended in the subsequent editions of the Summer Games in Rio de Janeiro (2016), Tokyo (2021) and Paris (2024). The changing discourses reveal the tensions between the IOC's agendas for the event, the motivations of the host cities and the realities of delivery in changing socio-economic and political circumstances. The discussion demonstrates the difficulty in incorporating the environmental imperative into the planning process when external pressures become too great.

Keywords: Olympics; sustainability; legacy; International Olympic Committee.

Introduction

Over the last thirty years, the concept of sustainable development, as a means to achieve a more environmentally benign basis for human development, has pervaded all aspects of modern life. It represents a response to the need to conserve finite natural resources, to reduce environmental pollution (especially the production of greenhouse gases to limit climate change) and to incorporate human dimensions of equity into economic progress. Sustainability, based on the three pillars of environmental, economic and social, now also forms a substantial part of staging mega-sporting events, such as the Olympic Games. Governing sports bodies, such as the International Olympic Committee (IOC), not only recognises its responsibility for the environment, but also that the international media interest in the Games provides an unequalled opportunity for raising global awareness of environmental and resource issues, and enhancing the profile and reputation of both the host cities and the IOC itself. With the agreement between the IOC and the International Paralympic Committee to stage the Paralympic Games in the same host cities and venues as the Olympic Games (since the Seoul Summer Games in 1988 and the Albertville Winter Games in 1992), it is important to emphasise that the promotion of sustainable legacies and the United Nations' Sustainable Development Goals (SDGs) are relevant to both governing bodies and events[1].

Host cities are required to demonstrate their environmental credentials in their bid to secure the right to stage the event, as well as to ensure that their approach is regarded as best practice[2]. The Games aspire to be a showcase for environmental good practice, in terms of infrastructure and building design, materials and construction;

[1] IPC, *Paralympics History*.
[2] IOC, *Sustainability Report*.

utility management and conservation (energy, water, waste); public transport provision; the formulation of sustainability and legacy plans; governance systems; and the monitoring of outcomes[3]. There are, of course, fundamental questions about whether flying thousands of people to another part of the world can ever be legitimately described as a 'sustainable' activity. The lack of tangible standards and effective oversight mechanisms by governing sports bodies have elicited criticisms of shallow ecological agendas, 'green-washing' and 'a hollowed out form of sustainable development'[4]. In addition, the conflation of the sustainability and legacy agendas has obfuscated accountability for the delivery of promised sustainability measures[5]. The aims of this paper are: (1) to explain the emergence of sustainable development and legacy in the context of the Summer Olympic Games; (2) to assess the outcomes of sustainability and legacy within recent Summer Olympic Games; and (3) to evaluate ongoing visibility of sustainability in the next editions of the Summer Olympic Games.

The emergence of Olympic sustainable development and legacy agendas

The emergence of sustainable development and legacy agendas within the Summer Olympic Games can be understood within the context of the growing scale and impact of the event[6]. From small-scale and poorly organised events with minimal urban impact in the first decade (1896 to 1904), the event became larger in scale, better organised and usually involved the construction of new purpose-built sports facilities (1908 to 1932) to become 'flag-ship' symbols of the host society with wider but modest urban impacts

[3] Kearins and Pavlovich, "The role of stakeholders in Sydney's Green Games".
[4] Hayes and Horne, "Sustainable Development, Shock and Awe?"
[5] Boykoff, "Green Games: The Olympics, Sustainability and Rio 2016", 196.
[6] Essex and Chalkley, "Olympic Games: catalyst of urban change"; Essex and Chalkley, "Mega-Sporting Events in Urban and Regional Policy: A History of the Winter Olympics"; Chalkley and Essex, "Urban development through hosting international events: a history of the Olympic Games"; Davies, "Beyond the Games: regeneration legacies and London 2012"; Lopes dos Santos, *et al.*, "Olympic Charter evolution shaped by urban strategies and stakeholder's governance: From Pierre de Coubertin to the Olympic Agenda 2020".

(1936 to 1956). Since 1960, the Games have often been used as a trigger for large-scale urban improvements and the event has consequently had much more substantial positive and negative effects on the economy, society and environment of their host cities. Many positive benefits, such as the installation of modern urban infrastructure, economic growth, innovative forms of governance and global image-making, have been generated by staging the Olympics. However, regeneration strategies based around mega-events have also been shown to create negative consequences, such as price-inflation, gentrification, community displacement and long-term viability issues, particularly for sports stadia. The scale and extent of the impacts led to claims of gigantism, where each edition of the Games tried to outperform the previous event in order to be proclaimed the 'best games ever'. The record of extravagance and dubious outcomes has fuelled the perception that the Olympic Games create venues and facilities that are 'white elephants'. Such perceptions are damaging to the image of the Olympic movement, which is reflected, over the last few years, in the considerable reduction in the number of potential host cities aspiring to bid and stage the event.

These effects have resulted in the introduction of measures to control the scale and impact of the event, such as the IOC sustainability and legacy agendas, which might be argued as a new phase in the trajectory of the Olympic Games, although the effectiveness of such measures can be contested. The International Olympic Committee wishes to present itself as an environmentally and socially responsible transnational organisation that conducts its business in an ethical manner and so has developed a sustainability agenda since the early 1990s, which now overlaps with a broader legacy agenda since 2007 to counteract these effects and criticisms. While

these agendas have sought to reduce any negative externalities of staging the Games, ironically, it might be argued that they have also contributed to the complexity and cost of organising and staging the event.

The origins of sustainability in the Olympic movement are traceable to the high-profile publicity afforded to the detrimental environmental damage caused by the Winter Olympics even as far back as the 1930s. For example, successful legal action on environmental grounds against the location of the original bob-sled run for the Lake Placid Games in 1932 required a less-sensitive site to be found[7]. However, it was the Winter Olympics in Albertville in 1992, where the intrusion of built structures into fragile environments, together with the use of chemicals to create the appropriate snow conditions, created international environmental concern[8]. The organisers of the next Winter Olympics in Lillehammer in 1994 were the first to adopt the principles of sustainable development in the infrastructural provisions for the Games, although this initiative was politically driven. The Norwegian Prime Minister at the time, Gro Harlem Brundtland, had been Chair of the UN Commission for the Environment which had produced the influential Brundtland Report on sustainable development in 1987. She recognised the role of the Olympics in raising the global profile of environmental action and wished Norway to demonstrate global leadership in this area[9]. Local organisers were forced to modify their preparations. The proposed location of one of the main indoor arenas was moved to protect a bird sanctuary, while its heat circulation operated from excess heat from its refrigeration unit. Contracts with suppliers and contractors included environmental clauses. This case illustrates that significant policy trends are

[7] Essex and Chalkley, “Mega-sporting events in urban and regional policy”, 219.
[8] May, “Environmental implications of the 1992 Winter Olympic Games”.
[9] Lesjø, “Lillehammer 1994: Planning, Figurations and the ‘Green’ Winter Games”.

often determined by local action rather than pro-active responses by the IOC: in this example, the adverse environmental effects of one Olympic Games influenced the agenda of the next, which coincided with international political leadership about sustainability.

Aware of its role as a global institution reflecting changing global values, the IOC adopted sustainable development as the third pillar of the Olympic Charter in 1996 (after sport and culture)[10]. The Charter stated that the Olympics would 'encourage and support a responsible concern for environmental issues, to promote sustainable development in sport and require that the Olympic Games are held accordingly'[11]. Since 1994, candidate cities have been required to describe their environmental plans in their bid documents[12]. In 1999, the IOC formulated an Agenda 21 for the Olympic movement to be monitored by the IOC Sport and Environment Commission. The focus of these initiatives was to reduce the environmental impact of the Games, although actions to increase the sustainability of the event were devised by the local organising committees.

For example, the organisers of the Sydney Summer Games of 2000 incorporated sustainable development as a core theme in its preparations. Faced with the local circumstances of a large-scale site remediation of toxic waste at Homebush Bay (the Olympic Park), the organisers took the opportunity to adopt environmental sustainability as a guiding principle in its Olympic preparations[13]. The Olympic Village

[10] Cantelon and Letters, "The Making of the IOC Environmental Policy as the third dimension of the Olympic Movement".
[11] IOC, *Olympic Charter*.
[12] IOC, *Final Recommendations for IOC Reform published, Press Release,* 5; Lesjø, "Lillehammer 1994: Planning, Figurations and the 'Green' Winter Games".
[13] Chalkley and Essex, "Sydney 2000: The 'Green Games'?".

also aimed at becoming a showcase for new green technologies, with pilot sustainable measures in the design, layout and construction using solar power, wastewater conservation and recycling[14].

By this time, the IOC was beginning to recognise the importance of securing wider positive legacies from the event. Consequently, sustainability began to become integrated within the broader goals of legacy[15]. It was during the preparations for the Sydney 2000 Games that the IOC first developed a knowledge programme in cooperation with the host city Organising Committee, which aimed at the formalisation of knowledge transfer between the IOC and former host cities to newly awarded future host cities. This process evolved to the creation of the Olympic Games Knowledge Management (OGKM) and an Information and Knowledge Management (IKM) unit to serve the IOC administration in 2003. Since 2020, both were combined to form the current IKL (Information, Knowledge and Games Learning). This measure enabled each new host city to learn from the experience of the previous hosts and so improve the efficiency of the event's organisation by preventing detrimental impacts from being repeated or through facilitating an improved response. As an attempt to provide a standardised methodology for recording the impacts of each Olympic Games, the IOC introduced the Olympic Games Global Impact Programme (OGGI) in 2003, which was renamed the Olympic Games Impact Study in 2007. The aim was to capture the impact of the Games using about 150 indicators in a consistent and comparable manner from one Olympiad to the next and over a period of 12 years from the pre-Games to the

[14] Spooner, *et al.*, "Solar Olympic village case study".
[15] Gold and Gold, "'Bring it under the Legacy Umbrella': Olympic Host Cities and the changing fortunes of the sustainability agenda"; Gold and Gold, "Olympic legacies and the sustainability agenda".

post-Games phases. The requirement for such monitoring was removed in 2017 as it had become too burdensome on host cities[16].

In 2003, the Olympic Games Study Commission (OGSC), set up to manage the inherently large scale, complexity and expense of staging the Olympic Games in the future[17], established new principles for the infrastructural implications. Permanent facilities were only to be permitted if a positive post-Games legacy could be demonstrated; the development of shared venues and facilities together with temporary installations were to be encouraged; reserved seating for dignitaries was to be reduced; the transfer of knowledge between host cities was to be promoted and the involvement of central and host city government throughout the planning process was to be optimised. In 2007, the IOC Charter was amended to include a new duty for the IOC: "…to promote a positive legacy from the Olympic Games to the host cities and countries"[18]. Legacy now needs to be considered by potential host cities even before the submission of their bid documents.

Since the global recession of 2008 and public opposition to the event in potential host cities, the IOC have experienced a reduction in the number of cities willing to bid for the Olympic Games due to the scale, cost and demands of the event[19]. These challenges have been interpreted as threatening the legitimacy of the IOC[20]. The Olympic Agenda 2020, agreed by the IOC in December, 2014, (and its successor

[16] Müller *et al.*, "An evaluation of the sustainability of the Olympic Games".
[17] IOC, *Olympic Games Study Commission: Report to the 115th IOC Session*, 4.
[18] IOC, *Olympic Charter*, Rule 2, Article 14.
[19] Lauermann, "The declining appeal of mega-events in entrepreneurial cities: from Los Angeles 1984 to Los Angeles 2028".
[20] Vanwynsberghe, Derom and Pentifallo Gadd, "Legacy and sustainability in the Olympic Movement's *new norm* era"

Olympic Agenda 2020+5 in 2021) revised the bid process to become an invitation and open dialogue between potential hosts and the IOC rather than as a tender bid. Olympic-related infrastructure can be negotiated to suit the city's long-term development needs rather than being imposed. The IOC also appears to be moving away from the concept of a spatially 'compact games' by allowing greater flexibility in venue locations, which can be outside the host city or even host country[21]. The extent to which these reforms will increase the enthusiasm of host cities to stage the Olympic Games will become apparent over the next few editions of the event. Nevertheless, for host cities, the institutionalisation of environmental considerations and sustainable development into the IOC's management of the Olympic Games has been to coerce, encourage mimicry of previous 'successful' strategies and, without IOC oversight and sanctions, even surpass normative practices[22].

Assessment of the outcomes from the Olympic sustainability and legacy agendas

The most comprehensive evaluation of the sustainability of the Olympic Games has been undertaken by Müller *et al.*[23], who devised a model of nine indicators to assess the 16 editions of the Summer and Winter Olympic Games between 1992-2020. Each indicator was scored by three assessors (with moderation) from least sustainable (0) to most sustainable (100) using a range of qualitative and quantitative sources, such as bid books, official reports, academic papers, and media/non-government organisations reports. The results produced some notable insights into the sustainability of the Olympic events. First, the mean scores for each dimension were

[21] IOC, *Olympic Agenda 2020: Context and Background*; IOC, "Bidding for Success: by invitation"; IOC, *Olympic Agenda 2020+5*.
[22] Pentifallo and Vanwynsberghe, "Blame it on Rio".
[23] Müller et al., "An evaluation of the sustainability of the Olympic Games".

broadly consistent (ecological 44/100; economic 47/100; social 51/100). The lowest scoring indicator was 'budget balance' (mean=26), reflecting the escalating costs of construction, although the highest scoring indicator was 'long-term viability' (mean=76), indicating that many of the Olympic venues had secured viable legacy uses. Second, despite advances in the concept and knowledge transfer, Olympic sustainability had declined over time: events between 1992-2008 had a mean score of 53, while events since 2010 had a mean of only 39. Third, the most sustainable Olympic events were Salt Lake City in 2002 (mean=71) and Albertville in 1992 (mean=69), despite the latter's label as one of the most environmentally damaging editions. The least sustainable Olympics were Sochi in 2014 (mean=24) and Rio on 2016 (mean=29).

There are a number of possible explanations for these findings. First, the terms 'sustainability' and 'legacy' are very malleable concepts, which can be interpreted in many different ways. Many of the sustainable development projects adopted by Olympic host cities, even as late as 2008, might be described as conventional and unsophisticated measures, reflecting the IOC's shallow ecological concerns directed at reducing negative environmental impacts rather than promoting ecological values[24]. Arguably, it has only been since 2010 that more positive and substantive contributions to sustainability have become components of Olympic preparations, which coincide with the emergence of the legacy agenda.

Second, the introduction of new progressive benchmarks has not inspired subsequent Olympic hosts to adopt similar principles and practices. Some events, such as

[24] Loland, "Olympic sport and the ideal of sustainable development", 145.

Lillehammer in 1994, Sydney in 2000 and London in 2012, have created such benchmarks, while other hosts have not done so, partly because local environmental politics were not able to incorporate international norms (for example, Sochi in 2014). Another explanation relates to the time-lag between the establishment of a new benchmark and its implementation – often after the next host city has been appointed. The seven-to-nine-year preparation period for an Olympic Games means that host cities which have already been awarded the right to stage the Games cannot be expected to adopt new principles part way through their preparations. The trajectory of sustainability measures in successive Olympic Games is therefore not progressive. The IOC's policy has been criticised for representing symbolic commitments to sustainability, especially given the constraints imposed by costs and tight deadlines[25].

Third, the sustainability and legacy agendas are ineffective because the interests of the IOC (as the principal) are different from the delivery agents in the host city, who hold the power in terms of information that might contribute to effective monitoring and compliance[26]. Host cities tend to downplay negative impacts and exaggerate positive effects, which the IOC fails to verify. Even if the IOC wished to sanction the agents by, for example, terminating the host-city contract, the financial and reputational costs for the IOC would work against such an action.

Sustainability trajectories of the Summer Olympic Games, 2012-2021

In order to demonstrate the variability in the implementation of the IOC sustainability agenda, the next section of this paper assesses the sustainability trajectories of the

[25] Kearins and Pavlovich, "The role of stakeholders in Sydney's Green Games", 160.
[26] Geeraert and Gauthier, "Out-of-control Olympics: Why the IOC is unable to ensure an environmentally sustainable Olympic Games".

most recent editions of the Summer Olympic Games. The London 2012 Olympic Games adopted one of the most ambitious and wide-ranging sustainability and legacy agendas, which established new benchmarks on a number of fronts, including a pre-planned legacy, an emphasis on urban sustainability, pioneering the first 'public transport Games', an emphasis on skills and training, an inspiration to youth, and new positive and inclusive attitudes towards disability. This Olympiad was the first to have been affected fully by the IOC's legacy agenda and so has had a pre-planned legacy from the outset of its preparations involving the regeneration of a tract of the East End of London. This section evaluates two issues: first, whether these agendas were delivered in London; and second, whether the sustainable legacy 'baton' was passed successfully to the subsequent Summer Olympic Games in Rio de Janeiro, Tokyo, and forthcoming in Paris.

Table 1 indicates that the main themes of the sustainable development strategies of the last four Summer Olympic Games have (unsurprisingly) incorporated similar themes, but with different groupings and terminology. Global environmental concerns, such as climate change, biodiversity protection, responsibility, and public awareness, have been well represented as core elements of sustainability. This central pillar exists alongside themes of regional growth and prosperity, encompassing sustainable building, transport/mobility, supply chains, waste management and technology, and the themes relating to social inclusion, including equality and diversity, education, employment skills, health, well-being and civic engagement. While these themes can be connected to all three pillars of sustainability, the rationalisation of the categories in each Olympics might have been adopted by any host city. Another explanation for the homogenisation of these

strategies is that their conception and communication would have been shaped by corporate NGOs offering global expertise and credibility[27]. The strategies for Tokyo are most cognisant of the locality of the host through the promotion of Japanese technology, culture, and economic recovery after the earthquake in 2011 (alongside Olympic values). The two-pronged objectives of the Legacy and Sustainability Plan for Paris are the most simple and clear cut: namely, the delivery of a more responsible Games and a social and environmental legacy.

<Insert Table 1 about here>

The London 2012 Olympic Games

The focus of the London 2012 Olympic Games was the Lower Lea Valley in the East End of the city. The site of the Olympic Park was a former industrial site and was presented in the bid document as a 'problem area', characterised by derelict and contaminated land, sewage works and a locality poorly connected to the rest of the city. The Olympics and Paralympics was seen as a once-in-a-lifetime chance to facilitate the regeneration of the area as one comprehensively planned unit[28]. Some important infrastructure projects had already been planned before the Olympic bid, such as the 'Stratford City' project by London and Continental Railways. Anchor projects, such as the Westfield Shopping Complex, would have occurred irrespective of the outcome of the Olympic bid. However, the coincidence of these projects fashioned conditions for a comprehensively planned redevelopment of the area

[27] Hayes and Horne, "Sustainable Development, Shock and Awe?"; Pentifallo and Vanwynsberghe, "Blame it on Rio".
[28] Smith *et al.*, *The 2012 Games: The regeneration legacy*.

under single land ownership with improved connectivity. These factors created circumstances that are very rarely possible in urban regeneration projects.

Once the bid for the 2012 Olympic and Paralympic Games had been secured in July, 2005, the process of regeneration began. A so-called 'Two-Four-One' Plan was established: two years of land assembly, four years of development and one year of testing for the event itself. The land assembly was undertaken by the London Development Agency (ODA) between 2005 and 2007 and involved negotiations with the numerous landowners as well as compulsory purchase. A total of 201 businesses were removed from the site during this period[29]. Between 2007 and 2011, the Olympic Delivery Authority, set up by an Act of Parliament in 2006, undertook the construction of venues and infrastructure. A single delivery authority was favoured rather than a joint body of the Olympic boroughs. In 2011-2012, the London Organising Committee of the Olympic Games (LOCOG) took responsibility of the Olympic Park for both the test events and the staging of the Olympic and Paralympic Games. In 2009, the Olympic Park Legacy Company was set up to plan the delivery of legacy, which was replaced in April, 2012 by the London Legacy Development Corporation. This governance model secured continuation of plans before, during and after the Games, which was fundamental for achieving a sustainable legacy.

As a response to the recommendations of the IOC's OGSC in 2003 and its emerging legacy agenda, the Master Plan[30] fixed the location of the venues, parks and infrastructure. The ODA's approach to the development of the Olympic Park was

[29] Raco and Tunney, "Visibilities and invisibilities in urban development: small business communities and the London Olympics 2012".
[30] ODA, *Lower Lea Valley Olympic and Paralympic Masterplan and Lower Lea Valley Legacy Masterplan*.

encapsulated by its adopted mantra of ‘Plan for legacy, overlay for Games’. Stadia were constructed either to have their capacity reduced after the Games, or to be temporary facilities. However, above all, the redevelopment was part of a wider ‘city project’ to create a new part of London with houses, employment, parkland, leisure facilities and transport connections.

In terms of delivery, the planning of the facilities and infrastructure at the Olympic Park was guided by a raft of strategies, covering sustainable development, design, employment, equality and inclusion, health, safety and security and legacy. Unusually, the ODA was both the planner and developer of the Olympic Park[31]. The planning function of the ODA was therefore split between the ‘Town Planning Promoter Team’, responsible for coordinating the preparation and submission of planning applications, and the ‘Planning Decisions Team’, responsible for development control and management through normal inclusive and democratic processes. Their role was to secure benefits and legacies through planning conditions and obligations (Section 106 agreements).

The other aspect of delivery was the construction of the venues and infrastructure on the Olympic Park. In September, 2006, the ODA contracted a delivery partner to project-manage this phase of the development[32]. An international consortium with the relevant private sector expertise and experience was appointed to deliver the construction: namely, CLM (CH2M Hill [now Jacobs], Laing O’Rourke and Mace). The consortium was paid £718m to project manage about 42,000 contracts involving the

[31] Hollingsworth and Shaw, “Learning Legacy: The role of the ODA as promoter and planning authority”.
[32] Epstein *et al.*, “Delivering London 2012: sustainability strategy”.

construction of the Olympic Park. Raco[33] has suggested that this delivery model of contractualism may become one of the main legacies of the London Olympics, although he raised concerns about its democratic accountability caused by the blurring of boundaries between the public and private sectors as the state becomes an 'intelligent client' and the governance process itself becomes privatised. Sustainability was built into the contracts and working arrangements with all the contractors and represents a pragmatic, non-ideological, contractual and output-based approach to sustainabilty[34].

The delivery of sustainable development through the London 2012 Olympics was established in a policy document in 2006 before being enshrined in a plan in 2007. The approach adopted was the concept of 'One Planet Olympics', whereby the Olympic-related development would be within the capacities of one planet, rather than three planets under resource consumption levels in the UK. The London 2012 Sustainability Policy established five headline themes as key policy areas to be delivered in the regeneration of the Olympic Park: climate change, waste, biodiversity, inclusion and healthy living[35].

A number of ambitious targets were set for both the construction phase and the operation of the Olympic Games facilities, including a 50% reduction in carbon emissions by 2013; 20% of energy requirements from renewable sources, and 20% of construction materials being reused or recycled[36]. Overall, the targets were exceeded

[33] Raco, "The privatisation of urban development and the London Olympics 2012".
[34] Raco, "Sustainable city-building and the new politics of the possible: reflections on the governance of the London Olympics 2012".
[35] LOCOG, *Towards a one planet 2012 (London 2012 Sustainability Plan)*; ODA, *Sustainable Development Strategy*.
[36] ODA, *Sustainable Development Strategy*.

in most cases. The delivery of these targets for sustainable development were achieved through contractual compliance, achieved by integrating the targets into project procurement contracts and the supply chain, and through active engagement with contractors to encourage innovations and cost savings. Clear performance targets to industry standards, such as the Building Research Establishment Environmental Assessment Method (BREEAM), Code for Sustainable Homes and Civil Engineering Environmental Quality Assessment and Awards Scheme (CEEQUAL), and a consistent methodology was used to benchmark performance. Whole-life approaches were taken to temporary structures, so that these could be re-used as a whole or in their component parts[37].

The London 2012 Olympic Games was the first Summer Olympics to be independently assured against its sustainability merits by an independent body, the Commission for a Sustainable London 2012[38]. It worked to influence outcomes rather than simply to confirm or challenge outcomes after the event. The final report on the achievements of the Olympics with regard to sustainability was published on 12 December, 2012. The body was wound up on 31 March, 2013. Other bodies, such as the Greater London Assembly, held the organisers to account during the preparations for the Games and urged further advances on some of the targets. For example, the London Assembly expressed concern that many of the sustainability achievements were not as impressive and exemplary as they might have been. Energy efficiency and renewable energy provision tended to be market best rather than innovative[39]. The facilities on

[37] Epstein *et al.*, "Delivering London 2012: sustainability strategy".
[38] Commission for a Sustainable London. *Breaking the tape: Pre-Games Review*.
[39] London Assembly. *London Olympic Games and Paralympic Games: the employment and skills legacy*; London Assembly. *Towards a Lasting Legacy: A 2012 Olympic and Paralympic Games update*; London Assembly. *Going for Green: Progress towards staging a sustainable Olympic and Paralympic*

the Olympic Park included solar panels and a biomass boiler using woodchip, but the planned wind turbine was cancelled. Much smaller turbines were installed in the Olympic Park, which fell short of the capacity lost by cancelling the single large scheme. The combined cooling heat and power plant utilised a fossil fuel (gas). In terms of the waste targets, demolition material was mainly recycled rather than being reused. However, attempting to secure innovative practice through mega-events such as the Olympic Games do confront the very real limitations of time, cost and practicability.

The second example of the delivery of legacy through the London 2012 Olympic Games is that of the 'socio-economic sustainability' legacies for the local population, namely employment and skills. The Olympics were hosted in the London boroughs of Hackney, Newham, Tower Hamlets, Waltham Forest and Greenwich ('the five Olympic boroughs'). A sixth borough, Barking and Dagenham, was added in 2010 to secure the legacy benefits across East London. These boroughs together represented one of the most deprived parts of the UK. About three-quarters of the wards were in the bottom quartile of the Index of Multiple Deprivation (2010), and were characterised by a low skills base, poor educational attainment; and high costs of housing, child care and transport, which often reduced the attractiveness of taking paid employment. The Olympics were grasped as an opportunity to alter the life chances of these deprived communities.

There were two main initiatives to continue towards this goal. First, the Local Employment and Training Framework, which was introduced as a condition of the

Games; London Assembly. *Review into the employment and skills opportunities of the 2012 Games-time period*.

original planning permission for the Olympic Park, focused on action in the Olympic boroughs (January, 2007 to December, 2009 funded by the London Development Agency). Second, there was the London Employment and Skills Taskforce Action Plan (October, 2006), which was a public-private partnership funded from existing schemes and the LDA to improve employment opportunities throughout London presented by the training opportunities for volunteers in the Olympics. The main issues with these schemes was whether volunteer work could transform motivations and so assist people into employment, and whether the most deprived groups in the population could be reached.

From 2009, the Olympic Host Boroughs worked on a Strategic Regeneration Framework, with the overall goal to achieve convergence with the rest of London by 2032[40]. The Convergence Framework themes were to create wealth and reduce poverty; support healthier lifestyles; and develop successful neighbourhoods. Monitoring of the success of the Convergence Strategy was undertaken using an agreed set of 20 indicators covering a range of employment, educational and health measures. From 2009 to 2013, over 12,000 residents were supported into employment through Games-related programmes and employment rates were shown to be narrowing. However, these results were not continued into 2015, which indicated that, while 11 indicators were on track to achieve convergence, four had a reduced gap but not to target and five had an increased gap. Significantly, unemployment, median earnings, obesity, recommended adult activity and overcrowding had all widened[41]. As a result, in 2015, a new Convergence Strategy and Action Plan (2015-18) was

[40] London's Growth Boroughs. Strategic Regeneration *Framework: An Olympic Legacy for the host boroughs*.
[41] London's Growth Boroughs. *Convergence Framework and Action Plan, 2015-18*.

published, which focused attention on increasing employment and wage levels, improving levels of skills and qualifications, and up-grading transport infrastructure to unlock growth in the boroughs.

Securing a post-event legacy, the creation of the London Mayoral Development Corporation on 1 April, 2012, following the Localism Act of 2011, and the London Legacy Development Corporation (LLDC) (Planning Functions) Order on 1 October, 2012, focused on the transformation of the Olympic facilities into the Queen Elizabeth Olympic Park. The aim was to create, by 2030, a sustainable and technologically exemplary place to live and work. The LLDC's Sustainability Framework[42] set equally challenging targets as the original Olympic development, including 25% minimum recycled content of major materials by value within new buildings and infrastructure; rainwater harvesting and greywater treatment; no home to be more than 350m from a bus stop; and 20% of car parking spaces to have access to electric-charging facilities. The LLDC's Equality and Inclusion Programme also promised Lifetime Homes, the London Living Wage and local employment opportunities[43]. Although a high level indicator of economic change, the Index of Multiple Deprivation at Local Authority level shows improvement in the rankings of the six Olympic boroughs relative to other neighbourhoods in England: from all boroughs being in the most deprived decile in 2010 to just two in 2015 and one in 2019[44] (Table 2).

Table 2 about here.

[42] London Legacy Development Corporation. *Your Sustainability Guide to Queen Elizabeth Olympic Park 2030*.
[43] London Legacy Development Corporation. *Equality and Inclusion Policy*.
[44] Ministry of Housing, Local Government and Communities. *National statistics: English indices of deprivation 2019*.

The Rio 2016 Olympic Games

Although the lessons emanating from London's experience and practices were transferred through the IOC Knowledge Transfer programme, the organisers of the Rio de Janeiro Olympics and Paralympics were not able to implement sustainability to the same level. Despite a sustainability plan built on three pillars: people ("Games for all"), planet (reducing the environmental footprint) and prosperity (accountability) together with the delivery of existing and temporary stadia (at 79% of venues), the country's significant economic downturn in 2015, political instability, and the outbreak of Zika virus in early 2016, all conspired to create an implementation gap. The organisers failed in several promised environmental goals made in its candidature file in 2009, especially related to regeneration, air and water quality, and reductions in the consumption of non-renewable resources[45].

One environmental promise made in Rio's orginal bid was to improve water quality in the venues for Olympic sailing, rowing, canoeing and kayaking, namely Guanabara Bay and Lagoa Rodrigo de Freitas[46]. Two sanitation upgrade systems, to treat 80% of sewage by 2016, were postponed until 2035 and river treatment units failed to be installed. An investigative press report in 2015 revealed that the Olympic water sports venues were unsafe because of high levels of human waste and associated viruses and bacteria, which posed severe health risks to athletes and residents.

[45] Boykoff, "Green Games: The Olympics, Sustainability and Rio 2016"; Boykoff and Mascarenhas, "The Olympics, sustainability, and greenwashing: The Rio 2016 Summer Games".
[46] Boykoff, "Green Games: The Olympics, Sustainability and Rio 2016".

The re-introduction of golf as an Olympic sport at the Rio Games led to the construction of a new golf course close to the Olympic Park and Village, despite the limited reach of the sport in the country. The site selected was the Reserva da Marapendi, which was one of the remaining wetland spaces in the region and had been designated an Area of Environmental Protection. An executive decree changed the zoning laws for the reserve on the basis of reducing the cost of Olympic facilities and creating a new legacy for the city. Despite public opposition, the new golf facility was developed and the changed building-height limitations (from 6 to 22 floors) opened the region to real-estate speculation[47]. Given the recommendations of the IOC's Agenda 2020+5, which stipulates that no permanent Olympic construction should take place in statutory nature and cultural protected areas, it might be hoped that such an action would never be implemented in a future host city.

The site of the Olympic Park in Rio was a former racing circuit at Jacarepagua Lagoon in Barra da Tijuca, in proximity to venues that had been used for the 2007 Pan-American Games. The site was planned in three-phases following the London model: event (2016), transition (2018) and legacy (2030), with the latter stage involving the park's transformation into a high-density mixed-use neighbourhood. However, its implementation was affected by political and economic pressures, which introduced modifications that compromised several legacy outcomes, including the location of venues, the balance of permanent and temporay facilities and use of materials. For example, the site of the Aquatics stadium was relocated in order to free land for future real estate residential development along the waterfront[48]. Similarly, the construction

[47] Gaffney, "Between discourse and reality: the un-sustainability of mega-event planning", 3934.
[48] Sanchez and Essex, "Architecture and Urban Design: The shaping of Rio 2016 Olympic Legacies", 105.

of the Olympic Village (Ilha Pura) took advantage of 'altered zoning laws, changed building heights, and … plot utilisation coefficients favoured by private developers'[49]. The gated complex, comprising high-rise towers with private green areas and no public services, was at odds with the traditional consolidated neighbourhoods in other parts of the city.

In the years following the Games, the original plans for dismantling of temporary venues did not materialise due to poor governance. Furthermore, the utilisation of venues for social projects and competitions had a very short lifespan after the Games, with part of the venues being managed by the Municipality of Rio and part of them by the Olympic Legacy Governance Authority (AGLO in the Portuguese acronym). With AGLO's closure in 2019, and political controversies after the election of a new mayor from a different party for the period 2017-2020, most of the structures have remained unused. The public linear park closed. In 2021, the re-elected mayor Eduardo Paes (2009-2016, 2021-2024) promised to resume the consolidation of Olympic legacies: namely, the conversion of the Handball Arena into four schools; the dismantling of the Aquatics Stadium and the technical gallery of the International Broadcasting Centre; the conversion of one of the Olympic arenas into a sports-oriented school (opened in February, 2024); and the reopening of the park as a public space. In 2023, the Federal Court of Accounts (the supreme audit institution) determined that the Ministry of Sports should produce a new long-term legacy plan with a sustainable management model of the Olympic legacy[50]. Given these instances of poor implementation of sustainable practices, it is little surprise that Rio

[49] Sanchez and Essex, "Architecture and Urban Design: The shaping of Rio 2016 Olympic Legacies", 111.
[50] Tribunal de Contas da União (TCU). *Acórdão 584/2023 – Plenário*.

was assessed to have been one of the worst environmental performances in the evaluation of the Olympic Games between 1992 and 2021[51].

The 2020/2021Tokyo Olympic Games

In contrast, the Tokyo Olympic and Paralympic Games appear to have fared better for environmental performance than the mean for previous Olympic Games. The initial projection for Tokyo before the event by Müller et al.[52] indicated a score of 40 points (ie below the mean of 48 points). A post-event study using the same methodology[53], but still with an incomplete data set, indicated an improved environmental performance, largely explained by the lower participation rates of athletes and spectators during the global pandemic (Covid-19). While this outcome for Tokyo 2021 should not be regarded as a new benchmark for future Olympics, the finding does illustrate the sensitivity of the ecological dimension of the model to the size of the event (ie the volume of international travel to, and the resource implications for, the host city).

Its bid in 2013 billed the event as the 'Recovery Games', following the earthquake, tsunami and nuclear incident at Fukushama in 2011. The bid sustainability strategy focused on achieving carbon neutrality, more green spaces in the city and raising environmental awareness and action through sport[54]. The bid goals and pillars related to the Organising Committee's final 'sustainability concept': 'Be better, together for the planet and the people'[55]. The targets set included moving towards zero carbon through utilising existing venues, carbon offsetting, 100% renewable electricity; zero waste

[51] Müller *et al.*, "An evaluation of the sustainability of the Olympic Games".
[52] Müller *et al.*, "An evaluation of the sustainability of the Olympic Games".
[53] Trendafilova, et al., "Tokyo 2020 Olympics sustainability: An elusive concept or reality?".
[54] Boykoff and Gaffney, "The Tokyo 2020 Games and the End of Olympic History", 3.
[55] TOCOPG, *Tokyo 2020 Action & Legacy Plan*.

through 99% reusing or recycling materials as well as rainwater recycling; the natural environment and biodiversity through a sustainable sourcing code and utilising timber loaned by local authorities from around Japan; and promoting volunteering, diversity and inclusion. The Legacy Report[56] indicates that these targets were met, with only six new facilities being constructed for the event (plus three post-2021). The Olympic Village on a waterfront site in West Harumi S-Chome district was transformed into Japan's first hydrogen-powered city, utilising the Bus Rapid Transport and cycle network installed for the Games. The Olympic medals had been made from redundant electrical appliances from around the country[57]. Despite these sustainability achievements, the Tokyo Games will be remembered as the 'Pandemic Games'.

The Paris 2024 Olympic Games

After a hiatus of 100 years, at the time of writing this paper, Paris is due to host the Summer Games for the third time in 2024 (after 1900 and 1924). The election of Paris as host city in 2017 was made at a ceremony when Los Angeles was also designated as the host for 2028 Olympics, following the withdrawal of three of the five initial candidate cities from the 2024 selection process. The preparations for the Paris Olympics were the first to have been fully affected by the IOC's Agenda 2020+5. The Paris 2024 Legacy and Sustainability strategy was built on two strategic pillars: to establish a more responsible model for the organisation and staging of major events and to consolidate the social and environmental transformation and legacy of the Games'[58].

[56] Tokyo Metropolitan Government, *Tokyo 2020: Legacy Report*.
[57] Tokyo Metropolitan Government, *Building the legacy: Beyond 2020*.
[58] Paris 2024 Organising Committee for the Olympic and Paralympic Games, *The Legacy and Sustainability Plan*.

The approach adopted by Paris in its Olympic preparations was a ‘circular heritage model’, whereby existing cultural and sporting infrastructure were utilised in order to reduce direct costs related to new construction as well as reduce carbon emissions[59]. About 95% of its sports venues were to be either existing or temporary structures, including the Yves-du-Manoir Stadium, which served as the main venue for 1924 Olympics. While the actual re-utilisation of venues might be lower than this target (at 79% according to some observations[60]), the approach has substantially reduced the cost of the event to E8.8bn (cf London E13bn; E16bn Rio and E12.1bn Tokyo)[61]. The proportion of re-used buildings is likely to be surpassed in the Los Angeles 2028 Olympics[62]. Paris has also promised a reduction of 55% in carbon emissions compared to Rio 2016 and London 2012, which was anticipated to be achieved partially through the lower levels of construction as well as the choice of construction methods and materials. Energy management, waste recycling, carbon neutrality and certified offset projects are other measures introduced to reduce the carbon footprint.

The only new permanent sports facility has been the Aquatics Centre, which is a modular timber structure planned as a 5,000-seat facility during the Games and reduces to 2,500-seats in its legacy mode. The venue is self-sufficient in energy as its roof was covered with photovoltaic panels. The Olympic Village, Media Centre and the Arena Porte de la chapelle in the Seine-Saint-Denis area of the city are the only other new Olympic-related facilities. The Media Village is a hyper-modern garden city. Unlike past host cities, Paris did not build an Olympic Park and spread the competitions around different sites across the city. Moreover, it will be the first host city to stage its

[59] Ricordel, “The circular heritage model of Paris 2024”.
[60] Wolfe, “Building a better host city? Reforming and contesting the Olympics in Paris 2024”, 265.
[61] Ricordel, “The circular heritage model of Paris 2024”, 407.
[62] Ricordel, “The circular heritage model of Paris 2024”, 410.

opening ceremony outside an Olympic Stadium through the utilisation of the River Seine, which offers free access for most of the spectators and resonates with the idea of staging an inclusive Games. The water quality of the Seine has been improved through a E1.5bn upgrading of treatment systems (*'plan baignade'*) to a level that permits swimming. The 'circular heritage model' is anticipated to be a legacy of the Paris Games in itself[63].

The social legacies of the Paris Games are to be achieved through employment initiatives in the main area of new Olympic venues: the Seine-Saint-Denis prefecture/department[64]. As a socially deprived part of the city, there was an opportunity to utilise the potential of the Olympic Games as a catalyst for innovation of new approaches and the coordination of a range of relevant public and private sector partners[65]. These partners came together in a 'Committee for Employment and Integration into the Workforce', who formulated an action plan, '*emploi JOP de Seine-Saint-Denis*', and created the '*Emploi JOP 93*' organisation to prioritise the recruitment of local people into companies involved in Olympic-related construction and operation (such as catering, security and logistics).

Ricordel[66] has identified three key implications of the approach taken by Paris. First, as the first host city to have been affected by the reforms of the IOC's Agenda 2020+5, which has allowed local government to align the extent of Olympic-related development to the context of the host city, the controversies over social and spatial exclusion resulting from the construction of new facilities and infrastructure have

[63] Ricordel, "The circular heritage model of Paris 2024", 416.
[64] Gignon, "Public policies and governance of the 2024 Olympic and Paralympic Games".
[65] Gilbert, "The Olympic Games: social and environmental innovation".
[66] Ricordel, "The circular heritage model of Paris 2024".

remained. Second, there is a question about whether the reduced extent of new development will also reduce the local impact and long-term legacy from the event. Third, an implication of the wider adoption of the 'circular heritage model' might be to restrict the location of future Olympic Games to host cities with existing facilities and infrastructure that can be refurbished.

Conclusions

After decades of high expectations and extravagence in the infrastructural investment related to the preparation of the Olympic Games, the profile of sustainability has risen since the 1990s with the emergence of an overlapping legacy agenda since 2003. With new dimensions added to the concept of sustainability, the consolidation of the UN Sustainable Development Goals and ever-evolving frameworks to address the matter, it has become clear that a purely environmental focus as seen in the 1990s has certainly shifted towards social sustainability, involving social inclusion, wellbeing, economic viability/accountability, as well as sustainable constructions and technologies.

The London 2012 Olympic Games were the first to plan comprehensively for the legacy from the initial bid through to the long-term regeneration of the Olympic Park in the post-Games period. In doing so, the organisers set new benchmarks for Olympic-related development, although the long-term delivery of these promises might be contested. The subsequent Summer Olympic events failed to develop this trajectory, with the Rio Games hijacked by the economic viability drivers of private real estate and the Tokyo Games proceeding under very unusual conditions following the pandemic (Covid-19). As revealed in Geeraert and Gauthier's analysis (2018), there is a

fundamental weakness in the IOC's governance of the sustainability and legacy obligations of Olympic host cities, namely that penalties for a lack of compliance with the IOC's guidelines and/or bid promises are likely to create devastating reputational risks to all concerned. In this context, it is clear that IOC sanctions are almost impossible to implement without significant ramifications on the Olympic movement and that the current practice is the only diplomatic and realistic strategy for the continuation of the event.

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Table 1. Summary of main themes of the Sustainable Development Strategies for the Summer Olympic and Paralympic Games, 2012-2024

	London 2012		Rio 2018		Tokyo 2021		Paris 2024	
Document	**LOCOG *London 2012 Sustainability Plan (2007) and* ODA *Sustainable Development Strategy* (2007).**		***Focus: Rio 2016 Sustainability* (2015)**		***Tokyo 2020 Games Foundation Plan* (2015) / *Action and Legacy Plan* (2016)**		***The Legacy & Sustainability Plan* (2018)**	
Pillars/themes	Climate change	Water	People	Engagement and Awareness Raising	Sport and Health	Promotion of Olympic and Paralympic values in Japan and throughout the world	Delivering more responsible Games	Eco-responsible Games that harness sustainable solutions
		Carbon		Universal accessibility		Benefits from increase in health consciousness and activated community sport		Games that boost regional growth and appeal
	Waste	Waste		Diversity and inclusion		Enhancement of top athletes' international competitiveness		Games that open up opportunities for everyone
		Materials	Planet	Transport and Logistics		Improvement of social and international status of athletes/enhancement of transparency and fairness in the entire sport world	Building the social and environmental legacy of the Paris 2024 Games	Sport to improve health, education and civic engagement
	Biodiversity	Biodiversity and Ecology		Sustainable Building		Transformation in people's consciousness and development of an inclusive society built by the momentum of the Paralympic Games		Sport to improve inclusion, equality and solidarity
		Land, Water, Noise and Air		Conservation and environmental recovery	Urban planning and sustainability	Effective utilisation of Games-related facilities		Sport to drive the environmental transformation
	Inclusion	Inclusion	Prosperity	Waste management		Implementation of urban planning to ensure secured and comfortable living for everyone		
		Employment and Skills		Sustainable supply chain		Communicate the importance of sustainability through efforts triggered by the Games		
		Transport and Mobility		Management and reporting	Culture and Education	Communication and succession of cultures of Japan and the world through the cultural programme and other events		

		Access			Promotion and succession of Olympic and Paralympic values through the education programme	
		Supporting Communities			Training of human resources who actively participate in activities of the international society and local communities	
	Healthy living	Health and Wellbeing			Development of respect for diversity	
				Economy and technology	Contribution to the recovery of Japan's economy and getting its growth on track in full-scale through the Games	
					Communication of Japanese scientific and technological innovation by showcasing the games	
				Recovery (from the Great Earthquake), nationwide benefits and global communication	Support and show the world the recovery of the areas affected by the Great East Japan Earthquake	
					Promotion of the Olympic and Paralympic Movement by "All Japan" structure	
					Regional revitalisation of Japan and tourism promotion through the Games	
					Communication of Olympic and Paralympic values and Japanese values	

Table 2. Change in the Index of Multiple Deprivation rankings for London Olympic boroughs, 2010-2019 (where 1=most deprived and 326=least deprived)

Top line: Local Authority summaries: rank of average of LSOA ranks (decile in brackets)
Bottom line: Rank of proportion of LSOAs in most deprived 10% nationally (decile in brackets)

Olympic borough	IMD 2010	IMD 2015	IMD 2019	Rank change	Decile change
Barking and Dagenham	8 (1) 20 (1)	3 (1) 135 (2)	5 (1) 139 (3)	-3 +119	0 +2
Greenwich	19 (1) 29 (1)	50 (1) 172 (4)	60 (1) 191 (5)	+41 +162	0 +4
Hackney	1 (1) 1 (1)	2 (1) 49 (1)	7 (1) 78 (6)	+6 +77	0 +5
Newham	2 (1) 2 (1)	8 (1) 101 (3)	12 (2) 154 (5)	+10 +152	+1 +4
Tower Hamlets	3 (1) 3 (1)	6 (2) 24 (6)	27 (2) 175 (6)	+24 +172	+2 +5
Waltham Forest	7 (1) 13 (1)	15 (1) 87 (5)	45 (1) 162 (5)	+38 +149	0 +4

Source: Ministry of Housing, Local Government and Communities (2011) *National statistics: English indices of deprivation 2019*, MHLGC, London. https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019 (accessed 11 March, 2023).