FIFA standard and environmental sustainability: thinking ahead

Padrão FIFA e sustentabilidade ambiental: pensando no futuro

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ABSTRACT

This study aims to identify opportunities for advancing the environmental sustainability standards established by FIFA. The study adopts a comparative approach to analyse how different environmental certifications relate to FIFA's stadium sustainability requirements. The process includes selecting comparable cases, defining the elements to be compared, and conducting a general comparative analysis. The findings indicate that the environmental sustainability aspects in FIFA's standards, as defined in the 2011 and 2022 documents, encompass dimensions such as carbon reduction, energy efficiency, sustainable water use, biodiversity, waste management, and green certifications. Standards such as B Corp, GRI, Carbon Trust, and ISO 14001 offer advances that could be incorporated into the FIFA standards. It is concluded that future developments of the FIFA Standard should consider incorporating internationally recognised environmental standards.

Keywords: Environment. Sustainability. FIFA. Standards. Smart Stadiums.

RESUMO

Este estudo tem como objetivo identificar possibilidades de avanço nos padrões de sustentabilidade ambiental estabelecidos pela FIFA. O trabalho adota uma abordagem comparativa para analisar como diferentes certificações ambientais se relacionam com os requisitos de sustentabilidade dos estádios da

FIFA. O processo inclui a seleção de séries comparáveis, a definição dos elementos a serem comparados e a comparação. Identificou-se que os aspectos de sustentabilidade ambiental no padrão da FIFA, conforme definidos nos documentos de 2011 e 2022, abrangem dimensões como redução de carbono, eficiência energética, uso sustentável da água, biodiversidade, gestão de resíduos e certificações verdes. Padrões como B Corp, GRI, Carbon Trust e ISO 14001 oferecem avanços que poderiam ser incorporados ao padrão da FIFA. Conclui-se que futuros avanços no padrão FIFA devem considerar a incorporação de normas ambientais reconhecidas internacionalmente.

Palavras-chave: *Ambiental. Sustentabilidade. FIFA. Padrão. Estádios Inteligentes.*

1 INTRODUCTION

The theme of environmental sustainability has become increasingly relevant globally as concerns about climate change, pollution, water scarcity, and other environmental challenges grow. In the academic field, researchers study sustainability in its economic, social, and ecological dimensions (Kashaba; Rehan, 2020; Oliveira; Faria, 2019). In the sports industry, although relatively recent, sustainability has become an irreversible trend, manifesting in various ways, including the need to minimise the environmental impact of sports facility renovations and construction (Kashaba; Rehan, 2020; Tavares *et al.*, 2018).

With the rise of large multi-purpose arenas, their role extends beyond hosting sporting events to include opportunities to promote environmentally responsible practices (Francis *et al.*, 2023). The Fédération Internationale de Football Association (FIFA), football's governing body, recognises the urgent need to promote environmentally sustainable standards in stadiums worldwide (FIFA, 2011; FIFA, 2022). In FIFA competitions, strong environmental sustainability goals have been established and expanded, including efficient energy use, reduced water consumption, and the use of local materials (FIFA, 2022; Khashaba, 2020).

In 2022, Qatar committed to hosting a sustainable FIFA World Cup (Al-Hamrani *et al.*, 2021), following FIFA sustainability guidelines similar to those adopted for the 2014 renovation of the Maracanã Stadium (Tavares *et al.*, 2018). Another important Brazilian example is the Mineirão Stadium, also used in the 2014 World Cup. Achieving the highest LEED certification level **demonstrates** that the project sought not only compliance but also long-term economic benefits (Oliveira; Faria, 2019).

Stadium sustainability has been studied from several perspectives: analyzing zero waste through a stadium case study (Costello; Mcgarvey; Birisci, 2017); technical-economic analysis to improve energy efficiency and sustainability at Flaminio Stadium in Rome (Tiberi; Carbonara; Sforzini, 2017); a case study on sustainability-oriented stadium policy (Bunds *et al.*, 2019); measuring the economic impact of sustainable construction concepts in the Mineirão project (Oliveira; Faria, 2019); analysing social sustainability and the legacy of circular and shared economy in FIFA World Cup organisation (Kucukvar *et al.*, 2021); evaluating the effectiveness of Greenship certification in stadium construction projects in Indonesia (Hanif, 2022); and raising awareness about sustainability in stadiums (Cayolla; Quintela; Santos, 2022).

Despite existing studies, they have not focused on FIFA sustainability guidelines. Addressing this gap, the present study aims to identify opportunities to advance the environmental sustainability standard established by FIFA.

2 METHODOLOGY

The methodology of this study is based on a comparative document analysis to identify gaps in FIFA's environmental sustainability standards and propose recommendations for improvement. Comparative analysis enables the identification of similarities, differences, and patterns among institutional frameworks (Lor, 2019).

1.2 DOCUMENT SELECTION

The study analysed two key FIFA documents addressing sustainability in stadium design and construction: Football Stadiums – Technical Recommendations and Requirements (FIFA, 2011) and Football Stadiums Guidelines (FIFA, 2022). These were selected because they represent FIFA's main sustainability guidelines for stadium development. To develop the comparative framework, these documents were analysed alongside nine internationally recognised environmental standards and certification systems: B Corporation, Global Reporting Initiative (GRI), Carbon Trust, ISO 14001, ISO 26000, Sustainability Accounting Standards Board (Sasb), UN Global Compact, MSCI ESG Ratings, and Leadership in Energy and Environmental Design (Leed). These standards were selected due to their global relevance and broad coverage of environmental sustainability practices.

1.3 COMPARATIVE ANALYSIS

A comparative analysis was conducted to evaluate sustainability requirements in FIFA guidelines and the selected standards. Sustainability themes, requirements, and indicators were identified and organised into comparable categories, including carbon emissions, energy efficiency, water management, waste management, biodiversity, and environmental governance. These categories were then compared with FIFA guidelines to identify practices present in the standards but absent from FIFA's framework. This procedure enabled the identification of gaps and supported the synthesis tables presented in the Results and Discussion section.

1.4 PROPOSITION OF IMPROVEMENTS

Based on the identified gaps, recommendations were developed to improve FIFA's sustainability standards. These proposals draw on best practices observed in the analysed standards and aim to strengthen FIFA's framework by incorporating additional environmental management practices and monitoring indicators.

2 RESULTS AND DISCUSSION

2.1 ENVIRONMENTAL SUSTAINABILITY REQUIREMENTS OF THE FIFA STANDARD

The global commitment to sustainability has become a priority in many industries, and sport, including FIFA, is no exception. The Green Goal programme proposed by FIFA in 2011 outlines an approach to environmental sustainability, with goals such as responsible consumption, waste reduction, energy efficiency, and the promotion of public transport at FIFA events. Its main objective is to achieve climate balance by reducing greenhouse gas emissions (FIFA, 2011). In more recent documents from 2022, FIFA emphasises that its approach to the three sustainability dimensions — Social Development, Environmental Protection, and Economic Development — plays an important role in promoting sustainable actions in football stadiums worldwide.

FIFA aims to develop sustainable stadiums that address environmental and social concerns while supporting local economic growth (FIFA, 2022). This perspective seeks to lead by example and encourage other sectors to adopt responsible practices. FIFA's sustainability standards include key themes such as carbon reduction, energy efficiency, sustainable water use, biodiversity, ecology, waste management, and green certifications. These represent priority areas for promoting sustainability in football stadiums globally.

In stadium construction, carbon reduction has become increasingly important, especially regarding the embodied carbon of materials. FIFA (2022) proposes strategies such as optimising structural design, material substitution, adopting life cycle assessment, and selecting local renewable energy suppliers.

Carbon reduction also extends beyond the design phase through the offsetting of remaining emissions. Energy efficiency is another key pillar for reducing stadium emissions. Strategies include designing efficient thermal envelopes, using renewable energy sources, and adopting technologies such as photovoltaic panels, wind energy, geothermal systems, and solar thermal systems. Energy storage, primarily through battery systems, is also a viable solution for meeting demand during events and providing backup supply (FIFA, 2022). Sustainability also involves the responsible use of water, considering global water scarcity. Strategies include rainwater harvesting, water-saving technologies, and efficient management of sanitary and food facilities serving large audiences.

FIFA encourages innovations such as rainwater harvesting systems on stadium roofs and wastewater recycling (FIFA, 2022). Biodiversity and ecology are also considered in sustainable stadium development. FIFA highlights the importance of avoiding construction in areas with high ecological value and preserving such areas within stadium environments. Strategies include selecting sustainable materials, responsible timber management, creating green corridors, and providing habitats for wildlife. Waste management is another global challenge, and FIFA proposes strategies to minimise waste during construction.

These include selecting recyclable materials, understanding material dimensions, and specifying solutions such as precast concrete. Contractors are encouraged to establish ambitious waste reduction and recycling targets and to reuse existing structures whenever possible. Finally, green certifications such as Leed and Breeam represent a practical demonstration of FIFA's commitment to sustainability. These certifications evaluate the environmental performance of stadiums and recognise sustainable practices in design, construction, and operation.

Despite additional costs, FIFA considers certification an investment that promotes sustainability and aligns projects with development guidelines. FIFA (2011) had already emphasised the importance of these initiatives by highlighting that sustainable construction improves the environment and creates healthier spaces for society. Based on the themes and guidelines presented in FIFA (2011) and FIFA (2022), a synthesis was developed illustrating the sustainability concept within FIFA standards and the requirements for a stadium to become sustainable (Table 1).

Table 1 – Requirements for Sustainable Stadiums according to FIFA 2011 and FIFA 2022

Theme	*Requirement*
Carbon Reduction	Structural optimisation; substitution of steel and concrete with wood; use of local suppliers powered by renewable energy; low-carbon materials; life-cycle assessment.
Energy Efficiency	Efficient thermal envelope; renewable energy use (photovoltaic, geothermal, etc.); energy storage systems; efficient technologies.
Sustainable Water	Rainwater harvesting; water-saving technologies; efficient water management in facilities and irrigation; wastewater treatment and reuse.
Biodiversity and Ecology	Avoid construction in high ecological value areas; preserve ecological zones; create green corridors; use sustainable materials and support habitats.

Theme	Requirement
Waste Management	Recyclable materials; waste reduction during construction; reuse of demolition materials; circular-economy practices.
Green Certifications	Green building certifications (Leed, Breeam, Green Building Star, carbon footprint); environmental performance evaluation and compliance.

Source: The authors.

2.2 ENVIRONMENTAL STANDARDS

Environmental certifications in buildings provide economic, social, and environmental benefits, including cost reduction, improved safety and health, the promotion of sustainability, and the efficient use of natural resources (Lamy *et al.*, 2021). These certifications go beyond FIFA guidelines and play an important role in promoting positive environmental impacts in the global sports context. This section presents the main environmental standards, each accompanied by a synthesis table describing sustainability requirements and recommendations.

The B Corp Certification directly influences business operations and sustainable strategies. Certified companies demonstrate a commitment not only to legal compliance but also to responsible environmental practices. The B Corp certification helps communicate these commitments, strengthening relationships with funders and attracting investors aligned with sustainable values (Paelman *et al.*, 2023).

Regarding environment and sustainability, B Corp Certification requires companies to obtain at least 80 points on a 200-point scale, with 20 points related to environmental criteria. Impact areas include governance, workers, community, environment, and customers. Environmental criteria assess facility efficiency, environmental management, certified products, energy consumption, water management, waste management, and ecosystem conservation practices (Diez-Busto; Sanchez-Ruiz; Fernandez-Laviada, 2022).

Companies with annual revenue below $5 million and fewer than 50 employees may apply for Pending B Corporation certification. The process includes the assessment of environmental efficiency, natural resource management, emissions and waste, products and services, and environmental responsibility. Examples of practices include reducing water and energy use, minimising waste and greenhouse gas emissions, evaluating the environmental impacts of products and services, adopting sustainable purchasing practices, using sustainable transport, ensuring transparent environmental communication, and investing in environmental innovation (B Corporation, 2022).

Table 2 presents a synthesis of environmental requirements by category of the B Corp Certification.

Table 2 – Synthesis of Environmental Requirements by B Corp Certification Category

Category	Aspects considered in the requirements
Environmental Management	Facility efficiency. Environmental management systems. Certified products. Environmental assessment and product development.
Air and Climate	Monitoring of energy use, renewable energy, electricity sources, low-impact energy, eco-friendly equipment, energy reduction, GHG emissions (Scopes 1, 2, 3), carbon intensity, GHG reduction, shipping policies, supply chain emissions management, supplier offsets, local purchasing, and transport impacts.
Water	Monitoring of water use, total consumption, conservation, captured or recycled water, toxic wastewater, disposal, and supply chain water management.
Land and Life	Monitoring of non-hazardous and hazardous waste, disposal, recycling, waste reduction, supply chain waste, packaging impacts, recyclable or biodegradable materials, preferable inputs, hazardous materials, chemical management, and biodiversity impacts in the supply chain.

Source: The authors.

The main areas of study related to the Global Reporting Initiative (GRI) encompass research on the implementation and impact of GRI guidelines in organisational sustainability reporting practices, including the measurement of sustainable performance. In Environmental Science, research covers the assessment of environmental performance, sustainability indicators, and environmental reporting, exploring the environmental impact of corporate practices, among other topics. Additionally, there is a comprehensive analysis of the financial risks and returns associated with sustainability, along with integrating Environmental, Social, and Governance (ESG) criteria into financial assessments (Evahdati; Aripng, 2023). Table 3 provides a synthesis of environmental requirements by GRI category:

Table 3 – Synthesis of Environmental Requirements by GRI Category

Category	*Requirements*
GRI 3: Materials 2021	Report the use of renewable and non-renewable materials. Demonstrate sustainability through the incorporation of recycled materials. Assess efficiency in product and packaging reuse.
GRI 302: Energy 2016	Quantify and categorise organisational energy use. Disclose environmental impacts beyond organisational boundaries. Measure energy efficiency based on organisational characteristics. Demonstrate reductions in energy consumption and improvements in energy efficiency.
GRI 303: Water and Effluents 2018	Report interactions with water and related impacts, including stakeholder engagement and water management. Define effluent discharge standards considering impacts on receiving water bodies. Specify water withdrawal sources, including water-stress areas. Report discharge types and priority substances. Present total water consumption and storage changes causing significant impacts.
GRI 304: Biodiversity 2016	Describe operational sites in biodiversity areas. Report positive and negative biodiversity impacts, affected species, and impacted areas. Identify protected or restored habitats and restoration success. Classify species in affected areas and extinction risk levels.
GRI 305: Emissions 2016	Report direct GHG emissions (Scope 1) including gases and base year. Exclude carbon market transactions and report biogenic CO_2 separately. Distinguish indirect emissions (Scopes 2 and 3). Calculate emissions intensity and demonstrate reductions in emissions and energy use. Report ODS production and significant air emissions.
GRI 306: Waste 2020	Report total generated waste by composition (excluding effluents). Report non-disposed waste and hazardous waste by composition. Report total disposed waste by disposal method.

Source: The authors.

The Carbon Trust Certification is accredited by the United Kingdom Accreditation Service (Ukas) to verify greenhouse gas emissions in accordance with ISO 14065:2007, using PAS 2050 and the Code of Good Practice. PAS 2050, developed by the British Standards Institution, establishes a globally consistent method for assessing greenhouse gas emissions throughout the life cycle of goods and services. It applies to various sectors, including Agriculture, Energy, Finance, Processed Food, Retail, and Tourism (Carbon Trust, 2023). The certification covers essential areas such as Environment, Social, Management and Ethics, and Quality, reflecting Carbon Trust's commitment to promoting sustainable and responsible practices across various industries. Table 4 provides a synthesis of environmental requirements by Areas for Carbon Trust Certification:

Table 4 – Synthesis of Environmental Requirements for Carbon Trust Certification

Areas	*Requirements*
Environment: Energy	Include greenhouse gas emissions and removals related to energy supply and use across the product lifecycle, according to PAS 2050:2011. Demonstrate appropriate emission factors for renewable energy and apply strict conditions for its use in processes. Account for emissions and removals from renewable electricity generation within defined system boundaries. Include emissions and removals from biomass use, covering production and combustion of biofuels, according to PAS 2050:2011.
Environment: Climate	Ensure that the lifecycle GHG assessment is comprehensive, consistent, and accurate in accordance with PAS 2050:2011. Monitor all emissions and removals, considering gases listed in Annex A from fossil and biogenic sources (except food products). Quantify emissions using the PAS 2050:2011 methodology. Implement GHG reduction programs. Exclude soil carbon changes in existing systems unless specific requirements apply. Estimate non-CO_2 emissions from livestock and soils using IPCC guidelines. Do not use GHG offset mechanisms during lifecycle emission assessment.

Source: The authors.

ISO 14001 is a global standard for environmental management that guides organisations in minimising their environmental impacts. It requires an environmental policy, planning, implementation, verification, and continuous review. It emphasises setting goals, considering legal requirements, preventing pollution, and seeking continuous improvement. Implementing it helps reduce impacts, comply with regulations, enhance image, and cut costs. It demands compliance, documentation, constant adjustments, and the prioritisation of environmental efficiency (ABNT, 2015). Table 5 provides a synthesis of environmental recommendations by category of ISO 14001:

Table 5 – Synthesis of ISO 14001 Requirements

Category	*Recommendation*
Environmental Policy	Establish an environmental policy focused on environmental protection and legal compliance. Adapt it to the organisation's nature, scale, and impacts. Document and communicate the policy publicly.
Planning	Conduct an environmental impact analysis to identify significant aspects. Develop action plans with measurable goals. Consider legal and regulatory requirements.
Implementation and Operation	Define roles and responsibilities to ensure resources. Implement procedures to achieve environmental objectives. Control activities with significant environmental impacts.
Verification	Monitor and measure activities with environmental impact. Report results to environmental authorities. Implement corrective actions for non-conformities with ISO 14001. Conduct environmental audits.
Management Review	Review the environmental management system before audits. Evaluate the need for changes in policies and objectives. Promote continuous improvement of environmental performance.

Source: The authors.

ISO 26000 is a global standard that provides comprehensive guidelines on corporate social responsibility and sustainability. Unlike ISO 14001, which focuses on environmental management, ISO 26000 addresses various aspects of social responsibility in organisations of all types (ABNT, 2010). It is not certifiable but serves as a guide for incorporating socially responsible practices.

The standard encompasses seven fundamental principles, emphasising responsibility, transparency, ethics, and respect for human rights. It highlights the importance of integrating social responsibility into daily practices, engaging stakeholders, identifying sustainability issues, transparency and communication, respecting human rights and labour standards, responsible supply chains, and promoting sustainable development (ABNT, 2010).

Implementing ISO 26000 helps organisations manage social and environmental impacts, comply with regulations, enhance their image, and reduce costs, promoting a holistic approach to corporate

social responsibility and sustainability (ABNT, 2010). Table 6 provides a synthesis of environmental recommendations by category of ISO 26000:

Table 6 – Synthesis of ISO 26000 Environmental Recommendations

Category	*Recommendation*
Community Engagement	Identify environmental impacts in operations. Promote transparency. Engage communities in environmental dialogue. Collaborate to address local environmental challenges.
Respect for Human Rights	Consider human rights in environmental decisions. Avoid impacts that violate rights. Protect affected communities. Support workers involved in environmental practices.
Fair Labour Practices	Ensure safe working conditions in environmental activities. Provide training for responsible practices. Promote equality and diversity. Prevent child labour.
Organisational Governance	Integrate environmental practices into governance. Establish environmental policies and goals. Ensure accountability for environmental impacts. Include indicators in governance reports.
Sustainable Consumption	Promote sustainable products and services. Provide transparent environmental information. Adopt sustainable production alternatives. Encourage responsible consumer practices.
Engagement with Governments and Regulation	Comply with environmental regulations. Collaborate with governments on environmental policies. Participate in initiatives promoting responsible practices. Ensure transparency with regulatory bodies.
Community and Society Development	Support sustainable community development. Collaborate with environmental social initiatives. Share knowledge and resources for environmental benefits.

Source: The authors.

The Sustainability Accounting Standards Board (Sasb), adopted by over 100 companies in 2019, is driven by financial motives, aiming to integrate comparable ESG metrics into SEC requirements. Funded by entities such as Bloomberg, Sasb developed 77 ESG standards in 2018. Companies have discretion in selecting relevant items, whereas Sasb focuses on financially material sustainability reporting related to ESG risks and opportunities. Seeking to enhance intangible value, it emphasises the importance of comprehensive disclosure and high-quality data for market discipline. In a context where investors seek sustainability as a competitive advantage, Sasb stands out as an evolution of traditional accounting standards (Parfitt, 2022; Pizzi; Principale; Nuccio, 2022). Table 7 presents a synthesis of environmental recommendations by Sasb category:

Table 7 – Synthesis of Sasb Environmental Requirements

Category	*Recommendations*
GHG Emissions	Control GHG emissions.
Air Quality	Implement actions to control Air Quality.
Energy Management	Conduct Energy Management.
Water and Wastewater Management	Implement actions for Water and Wastewater Management.
Waste and Material Management	Employ practices for Waste and Material Management.
Ecological Impacts	Minimise environmental impacts.

Source: The authors.

The UN Global Compact promotes sustainable development by bringing together businesses, organisations, and UN agencies. Its environmental principles include promoting a preventive approach to environmental challenges, developing initiatives for environmental responsibility, and encouraging eco-friendly technologies. To comply with these principles, companies must adopt environmental

policies, implement management systems, invest in sustainable technologies, and support sustainability initiatives. The UN Global Compact provides resources and support to assist companies in implementing these principles, aiming to contribute to a more sustainable future (UN Global Compact, 2023). Table 8 presents a synthesis of environmental recommendations by category of the UN Global Compact:

Table 8 – Synthesis of Environmental Recommendations from the UN Global Compact

Category	*Recommendations*
Preventive Approach	Operate proactively to identify and mitigate environmental challenges. Adopt preventive environmental policies aligned with the UN Global Compact's values and principles. Incorporate the preventive approach into the company's strategies, policies, and procedures.
Environmental Responsibility	Develop and implement environmental policies aligned with the Ten Principles of the UN Global Compact. Integrate sustainable development into the values and organisational culture. Promote environmental responsibility in all areas of operation.
Eco-Friendly Technologies	Invest in eco-friendly technologies that promote efficiency and sustainability. Encourage the development and dissemination of environmentally friendly technologies. Collaborate with industry partners to promote sustainable innovation. Adopt sustainable production and consumption practices.

Source: The authors.

O MSCI ESG Ratings, developed by MSCI, classifies companies from 'AAA to CCC' based on their environmental, social, and governance (ESG) performance. The environmental focus covers climate change, natural resources, pollution, and environmental opportunities. The environmental assessment considers management, energy efficiency, impact and environmental risks, regulatory compliance, sustainable innovation, and ESG transparency (MSCI, 2023).

The ratings, crucial for investment decisions, range from A to E. Leading companies meet criteria such as environmental policies, emissions disclosure, waste management, and sustainable resource use. These practices highlight companies committed to sustainability and contribute to a more responsible future (MSCI, 2023). Table 9 provides a summary of environmental requirements by category of MSCI ESG Ratings:

Table 9 – Summary of Environmental Requirements from MSCI ESG Ratings

Category	*Environmental Requirement Aspects*
Environmental Management	Assessment of direct and indirect GHG emissions. Measurement of natural resource consumption, including water and energy efficiency. Evaluation of waste management practices, such as recycling and waste reduction.
Energy Efficiency	Assessment of renewable energy use and commitment to renewable sources. Measurement of operational energy efficiency.
Environmental Impact and Risks	Evaluation of environmental risk identification, management, and reporting. Assessment of impacts on biodiversity and conservation areas.
Legal Compliance	Evaluation of compliance with local and international environmental regulations.
Sustainable Innovation	Assessment of investments in research and development of sustainable technologies and practices.
Transparency and Reporting	Evaluation of ESG disclosure and transparency of environmental practices.

Source: The authors.

Leadership in Energy and Environmental Design (Leed) is an internationally recognised certification system for sustainable buildings developed by the U.S. Green Building Council (USGBC). It assesses various areas, including water efficiency, greenhouse gas emissions, indoor air quality, use of recycled materials, resource utilisation, and maintenance and operation costs (GBC, 2023). The system awards points, totalling 110, and Leed ratings range from Certified (40-49 points) to Leed Platinum (80+ points).

The nine main categories include Location, Water Efficiency, Energy Efficiency, Material Selection, Indoor Environmental Quality, Integrative Process, Sustainable Sites, Regional Priority, and Innovation. Points are unevenly distributed among categories, with an emphasis on Energy and Atmosphere (34%) and Indoor Environmental Quality (16%). Leed certification covers various areas such as New Construction, Core and Shell, Schools, Retail, Data Centres, Warehouses, Hospitality, and Healthcare. Requirements include the choice of sustainable sites, water and energy efficiency, selection of sustainable materials, indoor air quality, and innovation in sustainable practices (GBC, 2023). Table 10 provides a synthesis of environmental requirements topics for scoring by Leed category.

Table 10 – Environmental Requirements for Leed Certification

Category	*Topics of Requirements for Scoring*
Location and Transportation	Leed for Neighbourhood Development. Sensitive land protection. High-priority sites in restricted or community-impact areas. High-density and mixed-use locations. Access to public transit. Bicycle facilities. Reduced parking footprint. Green vehicles.
Sustainable Sites	Construction pollution prevention. Site assessment. Habitat protection or restoration. Open space. Stormwater management. Heat island reduction. Light pollution reduction.
Water Efficiency	Reduction of outdoor and indoor water use. Building water metering. Cooling tower water use. Water monitoring.
Energy and Atmosphere	Enhanced commissioning. Optimised energy performance. Advanced energy metering. Demand response. Renewable energy production. Refrigerant management. Green power and carbon offsets.
Materials and Resources	Recycling storage and collection. Construction and demolition waste planning. Building life-cycle impact reduction. Environmental product declarations. Raw material sourcing. Material ingredient disclosure. Waste management.
Indoor Environmental Quality	Minimum indoor air quality. Tobacco smoke control. Enhanced air quality strategies. Low-emitting materials. Construction air quality management. Indoor air quality assessment. Thermal comfort. Interior lighting. Daylight. Quality views. Acoustic performance.
Innovation	Innovation. Leed Accredited Professional.

Note: The Table was constructed based on the general descriptions of the certification and scoring items for the New Construction category. Source: The authors.

In addition to the sustainability criteria themselves, environmental certifications also differ in their verification and auditing processes. Most certification systems require a structured assessment that includes documentation review, performance indicators, and, in some cases, external audits conducted by accredited organisations. These procedures may involve periodic monitoring, reporting of environmental indicators, and verification of compliance with predefined standards. The complexity, duration, and cost of these verification processes may influence organisations' and project developers' selection of a certification system. In the context of football stadiums, these factors may also affect the feasibility of incorporating certain certifications into FIFA sustainability standards, suggesting that the verification process should be considered when evaluating their potential adoption.

2.2 THE FIFA ENVIRONMENTAL SUSTAINABILITY STANDARD BEYOND THE CURRENT STANDARD

When examining FIFA's guidelines, it is evident that although they represent progress in sustainability, further improvements are needed to promote more comprehensive and responsible practices. During the comparison stage, in which the FIFA synthesis framework was compared with environmental certifications, it was possible to identify categories and areas not explicitly required in FIFA guidelines.

These areas were explored as analytical categories through comparative analysis. FIFA suggests implementing green building certifications, but does not explicitly require stadiums to obtain them. In addition, many

certifications establish recommendations or score-based criteria rather than mandatory requirements. These gaps reveal opportunities to strengthen FIFA's approach to environmental sustainability.

While FIFA addresses carbon reduction, energy efficiency, sustainable water use, and biodiversity, certifications such as B Corp, GRI, Carbon Trust, and ISO 14001 place greater emphasis on certified environmental management - seeking green building certifications, continuous environmental performance assessment, and compliance with defined criteria could be more clearly incorporated into FIFA guidelines. Although FIFA proposes optimising structural design and substituting materials to reduce carbon emissions, GRI, Carbon Trust, and MSCI ESG Ratings emphasise detailed monitoring of greenhouse gas (GHG) emissions. Including requirements for reporting direct emissions (Scope 1) and indirect emissions (Scopes 2 and 3) could strengthen FIFA's approach to climate change.

Regarding waste management, FIFA mentions recyclable materials, waste reduction, and the reuse of demolished materials. However, certifications such as B Corp and GRI highlight additional aspects, including supply chain waste management, packaging impacts, and hazardous waste monitoring. Life cycle assessment and energy efficiency, mentioned by FIFA in stadium construction, are addressed more comprehensively by certifications such as Carbon Trust and Leed, which emphasise applying these principles throughout the building life cycle.

Although FIFA promotes renewable energy use, it does not explicitly address energy consumption monitoring, a practice emphasised by certifications such as B Corporation, GRI, ISO 14001, Sasb, UN Global Compact, and MSCI. The UN Global Compact and ISO 26000 emphasise community engagement and transparency in environmental practices. While FIFA mentions local suppliers, clearer guidelines on how stadiums can promote local sustainability and transparency could generate additional benefits.

FIFA mentions sustainable materials, but Carbon Trust and the UN Global Compact highlight investment in environmentally friendly technologies and sustainable production and consumption practices. B Corp Certification highlights the environmental efficiency of facilities, environmental management systems, certified products, and environmental assessment in product development. Incorporating these elements into FIFA requirements could strengthen a holistic approach to environmental management in stadium construction and operation. ISO 14001, one of the most recognised environmental management standards, recommends conducting environmental impact assessments, developing action plans with measurable goals, and considering legal requirements. Integrating these stages into FIFA standards could provide a more structured environmental management framework.

The "Community Involvement" category of ISO 26000 highlights the identification of environmental impacts in operational areas and the promotion of transparency. Including these aspects in FIFA requirements could strengthen stadium integration with local communities and support regional socio-environmental development. Specific metrics for greenhouse gas emissions, energy efficiency, water use, and waste management, emphasised by Carbon Trust and Sasb, could help FIFA improve environmental monitoring indicators, enabling more measurable evaluation of stadium performance.

ISO 26000 and the UN Global Compact also stress engagement with governments, regulation, and community development. Integrating these elements into FIFA requirements could strengthen collaboration with local authorities and align stadium projects with sustainable development goals. The misalignment between FIFA standards and the environmental certifications analysed in this study highlights opportunities to strengthen FIFA's sustainability framework. Improvements are particularly needed in environmental management detail, impact assessment, community engagement, and measurable indicators, especially as climate-related challenges become more frequent.

Table 11 presents a synthesis of the gaps identified in FIFA's environmental sustainability standard based on the analysed certifications.

Table 11 – Summary of Missing Aspects in the FIFA Environmental Sustainability Standard,

Based on Analysed Standards

Requirement	*Standard*
Environmental management systems	B Corporation, ISO 14001.
Monitoring of energy consumption	B Corporation, GRI, ISO 14001, Sasb, UN Global Compact, MSCI.
Total Scope 1 GHG emissions (metric tons of CO2 equivalent)	B Corporation, GRI, Carbon Trust, MSCI.
Total Scope 2 GHG emissions	B Corporation, GRI, Carbon Trust, MSCI.
Total Scope 3 GHG emissions	B Corporation, GRI, Carbon Trust, MSCI.
Carbon emissions intensity	B Corporation, GRI, Carbon Trust, MSCI.
Reduction of greenhouse gas emissions	B Corporation, GRI, Carbon Trust, MSCI.
Shipping policies	B Corporation.
Management of GHG emissions in the supply chain	B Corporation, Carbon Trust.
Compensation for suppliers' GHG emissions	B Corporation.
Improvement in supply chain GHG emissions	B Corporation.
Percentage of purchases from local suppliers	B Corporation.
Percentage of raw materials purchased from local suppliers	B Corporation.
Management of transportation impact	B Corporation.
Monitoring and management of water usage	B Corporation, GRI, ISO 14001, SASB, UN Global Compact, MSCI.
On-site or recycled source water capture	B Corporation.
Monitoring of toxic wastewater	B Corporation.
Water management in the supply chain	B Corporation.
Improvement of water consumption in the supply chain	B Corporation.
Monitoring and recording of non-hazardous waste	B Corporation, GRI, ISO 14001, SASB, MSCI.
Waste disposal methods	B Corporation, GRI, ISO 14001, Sasb, MSCI.
Total disposed waste	B Corporation, GRI, ISO 14001, Sasb, MSCI.
Total recycled waste	B Corporation, GRI, ISO 14001, Sasb, MSCI.
Recycling programs	B Corporation, GRI, ISO 14001, Sasb, MSCI.
Waste reduction programs	B Corporation, GRI, ISO 14001, Sasb, MSCI.
Supply chain waste management	B Corporation.
Improvement in supply chain waste generation	B Corporation.
Environmental impact of packaging	B Corporation, GRI.
Percentage of recyclable/biodegradable materials	B Corporation, GRI.
Percentage of environmentally preferable input materials	B Corporation.
Monitoring of hazardous waste	B Corporation, GRI, ISO 14001, Sasb, MSCI
Total hazardous waste produced	B Corporation, GRI, ISO 14001, Sasb, MSCI
Waste reduction	B Corporation, GRI, ISO 14001, Sasb, MSCI

Requirement	Standard
Disposal of hazardous waste	B Corporation, GRI, ISO 14001, Sasb, MSCI
Management of hazardous materials on-site	B Corporation, GRI
Chemical substance management in the supply chain	B Corporation
Improvement in the generation of chemical substances in the supply chain	B Corporation

Source: The authors.

The comparative analysis of FIFA's sustainability guidelines with existing environmental certifications reveals important avenues for strengthening the FIFA standard. While FIFA's current guidelines address crucial aspects such as carbon reduction, energy efficiency, and waste management, incorporating specific elements from certifications such as B Corporation, ISO 14001, GRI, Carbon Trust, and others could provide a more comprehensive and detailed approach.

The inclusion of specific metrics, such as carbon intensity, the percentage of local purchases, and supply chain waste management, enables more detailed, measurable monitoring of the stadium's environmental performance. Furthermore, considering aspects such as the environmental impact of packaging and chemical management in the supply chain could significantly broaden the scope of sustainability in stadiums.

By following the best practices outlined in internationally recognised certifications, such as ISO 14001 and B Corporation, FIFA would have a more comprehensive framework for managing stadium environmental performance, promoting a proactive and integrated approach. This evolution in sustainability standards would not only align FIFA with global sustainable development goals but also contribute to the construction of more ecological and community-integrated stadiums. Additionally, the study's findings guide best practices for constructing various eco-friendly sports facilities, extending their impact beyond FIFA stadiums to other sports infrastructure projects globally.

This study presents some significant limitations that should be considered when interpreting its results. Firstly, the adopted comparative approach may be subject to selection bias, as the choice of environmental certifications for comparison was based on specific criteria. Additionally, covariance analyses rely on comparable data across certifications, which may affect the validity and generalisability of the results. Another limitation is the constant evolution of environmental standards and criteria, which may change over time. Furthermore, the analysis focuses on specific dimensions outlined in FIFA documents and may not comprehensively address all relevant aspects of each standard. Finally, it is essential to acknowledge that the study did not assess the practical implementation of these standards in specific stadiums, limiting the understanding of their real impact within the FIFA context.

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STATEMENT ON THE USE OF ARTIFICIAL INTELLIGENCE

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