

World Cup Organization as an Effective Tool to Drive Qatar's Vision 2030: Sustainability

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Abstract

The purpose of this paper is to identify the strengths, weaknesses, opportunities and threats (SWOT) that a host city can experience to utilize these for future strategy planning and event leveraging. Findings suggest that the strengths lie in having certain infrastructures in place, volunteers, a strong economy and good political standing. Weaknesses stem from a lack of infrastructure, the size of the country, uncertain political and economic stability. Opportunities included the growth of the tourism industry, business developments, and increase in the quality of life, the use of legacies post-event, and the improvement and development of infrastructures holding a mega-event such as the 2022 FIFA World Cup is a defining moment for Qatar, a country that is in transition, small in size and population, and rich in natural gas reserves. It is a unique opportunity to host a universal event and leave a sustainable positive legacy for the country. This study addresses the intersection between mega sports events and sustainability, to systematically compare and learn from past mega-events and apply that to the case of the Qatar 2022 World Cup. Herein, the challenges, opportunities, and progress are evaluated accordingly, showing that local organizers are applying green technologies and strongly upholding the idea of legacies based on the Qatar National Vision 2030, which envisions sustainable development of the country.

Keywords

Technology, New Technology, Emerging Technology, Mega Event and Sustainability.

1. Introduction

Holding a mega-event such as the 2022 FIFA World Cup is a significant moment for Qatar, a country that is in transition, small in size and population, and rich in natural gas reserves. International sporting events attract the attention of all sports fans and those in charge of organizing the event. It is considered one of the biggest opportunities to show the development of the hosting countries, and it abounds in the use and display of new types of technology. The case of Qatar is worth investigating to understand how the country is transitioning from traditional society to dynamic knowledge society and economy and analyzing key challenges ahead. The 2022 World Cup is no exception, as new innovations and technology have been implemented to elevate the event to a state of the art the world has not seen before. Going back to the history of the uses of emerging technology, the previous 2018 World Cup witnessed the use of video assistant referee (VAR) for first time in World Cup match the media celebrated this development and considered it an evolution of sports history (Grež 2018), addition to a number of technologies used to detect and measure the performance of players and referees and enhance the experience and participation of fans of the game.

As part of the Qatar 2030 vision, technology is considered one of the central elements in the state's policies, and induction is an opportunity to apply emerging technology since winning the hosting of the tournament in 2010, which in turn paves the way for long-term goals in sustainability, development plans, and innovation for members of the Qatari society (Government communication office 2008).

The State of Qatar has benefited from many technological sectors from inside and outside the country, which made the economic opportunities greater for the country, as it opened the way for emerging projects in the sports field through specialized business incubators in partnership between the aspire zone Foundation and the Qatar Development Bank joint initiative Qatar Sports Tech to help start-ups company building their new technology (Sports Tech 2018). The impact associated with the world cup event and Qatar vision contributed in development of the scientific fields, where the concept of business development and entrepreneurship began to rise and be embraced by educational authorities in Qatar, such as the Science and Technology Park in the development of technological innovation makes positive impact on country's tech ecosystem (Saleem 2023) , as well as Abdulwahed (2023) stated that using the knowledge of the event and the resulting returns in developing business projects and research projects as it show with Qatar University Office of Strategic Innovation, Entrepreneurship & Economic Development (SIEED).

According to Federation International de Football Association FIFA (2022), the tournament has adopted new means to enhance the games, such as the match ball which has an inner motion sensor capable of reporting the exact position data at the moment the ball is kicked, The semi-automated offside technology (SAOT) is a new support tool fortified with 12 tracking cameras fixed underneath the roof of the stadium for the VAR and on-field referees, the FIFA player application (FPA) by which players can access their performance data gathered through tracking system devices installed in multiple cameras mounted around the field, the goal-line technology helps to promptly decide when the match ball has crossed the goal line. The information is gathered using 14 dedicated high-speed cameras placed under the roof of the stadiums (Lemire 2022). According to Qatar Foundation (2022) mentioned that the cooling system which was developed by the college of engineering at Qatar University provided eight fully operative air-conditioned outdoor stadiums to host the 64 matches for the World Cup. Aspire zone foundation introduced SPF the facial recognition technology and drone surveillance at stadiums which has the latest facial recognition technology can zoom in on each of the spectators.

With a single click, the command-and-control center (ACCC) can shift views from one stadium to another stadium (SPF 2022). The use of Interceptor Drones (ID) aims at deterring potential attacks from other unmanned aircraft systems at the stadiums, as well as drone surveillance that can produce information about the number of people using city streets, it indicates the comparison between the highest and lowest adapter of the recent technologies showed the most efficient security facility for the FIFA 2022 World Cup was to counter the drones that pose security threats around the stadiums. The counter-drone technology aims to ensure sufficient security offered at the stadiums in Doha to detect and defeat dangerous drones. All of the above-mentioned technologies have played an important role in the success of the tournament and subsequently, Qatar as the host nation of the event.

The new technologies affected the success stories of hosting the FIFA 2022 World Cup in Qatar by conducting interviews with malty stockholder to find the link between the success stories and adoption of technologies, for instance, hosting the World Cup would offer a legacy to transform State of Qatar. Rago et al. (2020) addressed that adopting new technologies such as semi-automated football technology would create a legacy of success in emerging technology. Notably, the FIFA 2022 World Cup was a platform to identify economic gaps open for development and innovation (Regret Iyer et al. 2022). The various areas of technological adoption like knowledge of what effect technology bring this world cup investigation on best adaptable approaches and development of emerging technology areas will be study in this research by comparison between the stockholders to find out the highest and lowest sector that adapted technology.

Ensuring the new technologies used in FIFA 2022 World Cup find alignment in the 2030 strategic plan of Qatar. Research indicates that the legacy of football hosting in Qatar would contribute to developing other technology sectors to align with the country's strategic plan (Elagouz et al. 2022). Finding the alignment between local organizations in Qatar that working to document the experiences gained from the World Cup for research and development needs to use the experience in future sporting events such as the Olympics, or to use the experience in the various sectors involved in organizing events such as world exhibitions in environment, economy, and security to find economic and political outcome from the acquired knowledge. As Bizimungu (2022) stated that the United States looking for to

exchange expertise that could benefit from Qatar's expertise in organizing the 2026 World Cup events that will be hosting by three countries.

2. Literature Review

This paper seeks to explore the sustainability matters when applied to the case of the Qatar 2022 World Cup. As such, it undertakes first a methodological tool of the points between sustainability and legacy issues and SME, trying to surface the main fields of research on the pertinent topics, as well as some tentative frameworks, under which to evaluate the case study of the Qatar 2022 World Cup.

A scoping review was conducted to produce evidence from a variety of study designs in order to clarify key concepts and identify gaps in the published literature using the Arksey and O'Malley and updated by Joanna Briggs Institute (JBI) Framework for Scoping Reviews. Framework for scoping reviews as a guide. Unlike systematic reviews, which focus exclusively on a single question and review objective, a scoping review is a form of knowledge synthesis that addresses an exploratory research question aimed at mapping key concepts, types of evidence, and gaps in research related to a defined area or field by systematically searching, selecting, and synthesizing existing knowledge.

Because no comprehensive review of the research question has been conducted, the authors decided to conduct a scoping review to compile all available evidence on the subject before addressing more specific questions. Arksey and O'Malley's framework is divided into five components: defining the research question, identifying relevant studies, selecting studies, charting the data, and collating, summarizing, and reporting the results. The JBI framework or protocol is an extension of the previous framework, ensuring that a systematic approach is taken and that the process is transparent, SCOPUS database was used in search of relevant articles. An advanced search was conducted to identify sources containing the phrases "technology", "new technology", "emerging technology" and "mega event" as subject terms.

The sources were arranged chronologically, and their titles were checked for relevance and selected where deemed appropriate. No document type was excluded. The search strategy identified appropriate literature in the following database: Scopus. Between January 2003 and December 2023, the database was searched for the terms "sustainability", "technology", "new technology", "emerging technology", and "mega event".

Furthermore, journals were selected since the majority of articles published were relevant to this study. Additionally, Google and grey literature searches were conducted. The collection of literature was assessed for its importance according to its content and publication category. Then, the publication category was determined to make sure that only research articles and case reports issued in the English language were included. Other types of manuscripts were omitted, including editorial notes, reviews, book chapters and conference abstracts.

After identifying articles in the above-mentioned database, duplicates were removed. The eligibility criteria were used to accomplish an initial screening of articles based on their titles and abstracts. The full text of articles was then accessed to define which articles were qualified for addition in the review. A data extraction was used to extract study characteristics such as the author(s), the year of publication, the country of origin of the study, the research design, the population, the concept, and the context. To address the objectives, a narrative synthesis of the results was conducted. The studies, as shown in Figure 1, included in this paper are from 2003 to 2023. From 2003-2011, 16 studies were published. Following a five-year period, 22 studies were conducted until 2016, 10 articles from 2017 to 2018, 14 from 2019 to 2020, 25 from 2021 to 2023. Around 39 of the 87 articles were published within the last five years.

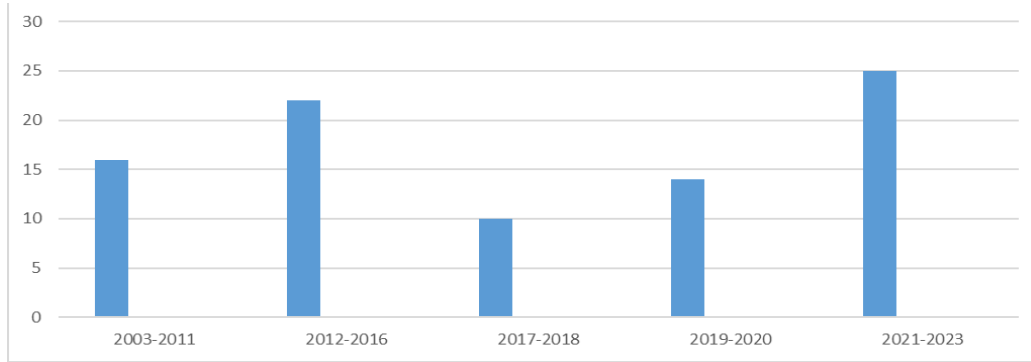


Figure 1. Numbers of articles were gathered between 2003 to 2023

As shown in table 1, the search extends to the pillars and challenges of Qatar’s vision 2030. The World Cup and the transformations brought by QNV 2030 generate great opportunities for the country to attract investment and tourism, they are actually a "double-edged sword" since all this international visibility can bring challenges of equal size for a society still very divided between modernism and tradition. Opportunities and challenges were thoroughly searched in this study.

Table 1. Qatar’s Vision 2030: Pillars and Challenges (Government communication office 2008)

| | | |
|--|--|---|
| <p>Human Development</p> <ul style="list-style-type: none"> • Educated population • Healthy population • Motivated workforce | <p>Major Challenges</p> <ul style="list-style-type: none"> • Modernization and preservation of tradition • Obey needs of this and future generation • Manage growth • Path of development • Economic growth and social development | <p>Economic Development</p> <ul style="list-style-type: none"> • Sound economic development • Responsible exploitation of gas and oil resources • Suitable economic diversification |
| <p>Social Development</p> <ul style="list-style-type: none"> • Social care and protection • Sound social structure • International cooperation | | <p>Environmental Development</p> <ul style="list-style-type: none"> • Balance between development needs and protecting environment |

As shown in figure 2, the primary search using the keywords identified 100 results. A total of 13 reviewed articles were left out due to imitated to English language and duplicate removal screening. The remaining 87 results from the Scopus database were evaluated for suitability on a case-by-case basis. As a final point, only 59 full-text articles, conference papers and book chapters met the appropriateness for inclusion.

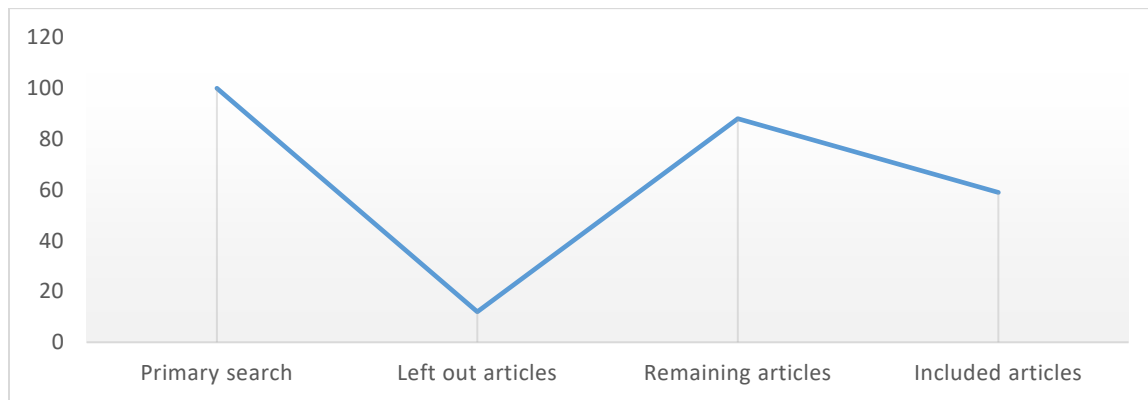


Figure 2. Result included articles

3. Historical background

Germany 2006 was the first recognized WORLD CUP to propose and implement a sustainable long-term greening agenda, with five points or “Green Goals” relative to energy, water, waste management, climate change neutrality, and efficient transport (Dolles and Soderman 2010). The final balance after the World Cup stated that Germany 2006 was a carbon-neutral event for the environment, a remarkable achievement, however Germany 2006 did not count the carbon offsetting of all the emissions related to international journeys of spectators and other participants for the World Cup, a large part of the real total carbon emissions (Kim et al. 2019). The bar raised by the German World Cup, in terms of sustainability, ecology, and other aspects, was difficult to surpass in South Africa 2010, a developing country with many cities ravaged by poverty and social inequality. South Africa organizers tried to emulate Germany with the implementation of a “Green Goal 2010” program, but focusing much more on social and economic issues such as infrastructure, job creation, and a national economic boost rather than on environmental impacts, with many piecemeal projects in the several host cities without a strong and coherent direction until very close to the World Cup event (Death 2011). Publications discuss that South Africa 2010 showed some good performance in terms of the green proposed goals but never reached the desired potential and lacked a more organized and integrated direction. Brazil 2014 was, to some extent, a similar experience as South Africa. Another developing country with multiple indexes of high poverty, economic crisis, and widespread corruption, Brazil saw the preparation and execution of multiple sports projects for the World Cup, among demonstrations of the people and community complaining of the use of such resources instead of leveraging them for country development (Cornelissen 2011).

Again, the environmental aspect of that confrontation was the most neglected and in some ways, a lost opportunity from what was announced to be the greenest World Cup. Russia 2018 is still a very recent World Cup, and the sustainability results remain to be evaluated, but some reports are stressing how the Russian organizers supported green building projects, trying to avoid “white elephant” experiences (Hayajneh et al. 2017) as in USA 1994 and South Africa 2010. Additionally, Russia World Cup 2018 was analyzed as an event that tried to show Russia as a reemerging power in need of revitalize cities away from Moscow, developing them urbanistic ally, a strategy coherent with the realization of the Sochi 2014 Winter Olympic Games. By comparison, Preuss (2013) compared the FIFA bidding requirements for Russia 2018 and Qatar 2022 vs. the IOC requirements for the 2020 OGs. While the OGs already require sustainable development structures in the OG bidding and preparation, the FIFA World Cups are more restrained to the carbon-decrease/neutrality footprint of the tournaments and environmental impacts; however, the FIFA Cups also require more specific environmental participation and structures from the managerial side. With all this background, Qatar wishes to rise to the occasion in terms of sustainability.

4. Discussion

The challenges found thus far are vast, and the solutions to them are neither quick nor unique, i.e., there is not a unique solution that fits all the challenges. They involve changes through generations and strong leadership, but they are necessary to correct the unsustainable effects and impacts described. Qatar 2022 could work in two ways: one in which it stresses more the problems and leaves negative effects/useless initiatives for the future; the other in which a sustainable legacy is satisfactorily achieved, working as a catalyzer for positive effects/impacts aligned with the realization of the QNV 2030 (GSDP 2008).

4.1 Doha’s challenge and responses

As a hosting country, Qatar has the chance to leave a long-lasting positive legacy for developing the capital Doha, its most important city and political-economic center, with an event that tests a new spatial model of World Cup. This model was first described as the “most compact” World Cup ever, similar in many ways to the OG spatial models, concentrating all the matches in a small central area. However, and unlike other Olympic cities such as Sydney 2000, Athens 2004, Beijing 2008, London 2012, Rio 2016, and any other any World Cup, this mega-event took place in a new urban area undergoing plain development. Doha was a small city just three decades ago, fairly unknown to the Western World, and quite ordinary among Middle East cities (Scharfenort 2012). Urban development progressed hand in hand with the outstanding growth of the Qatari economy, but when elected as the 2022 World Cup venue, many voices claimed its election as the outsider candidate, with a neighboring city such as Dubai presenting greater development into the “neoliberal Gulf model” and attractiveness (Konrad-Adenauer-Stiftung 2011).

Table 2. Qatar’s key challenges and responses

| Qatar National Vision 2030 pillar | Major challenges | Strategic responses |
|--|--|--|
| Promoting sustainable prosperity | Ensuring sustainability in a setting where hydrocarbon resource depletion is still the dominant source of income. Promoting stability in an environment where hydrocarbon price volatility. | Establishing a hydrocarbon depletion policy; sustaining high rates of saving and making sound investments in human, capital and reforming budgetary and fiscal processes, public investment programming, liquidity. |
| | Creates risk and presents challenges for calibration of economic policy. Enhancing efficiency in the use of all resources to support high standards of living for current and future generations. Diversifying the economy to create durable wealth and support wider societal viability | Management and domestic capital market development financial assets for the future. Promoting competition, trade and investment; improving regulation; strengthening demand management for water, power and fuel; reforming agriculture Bolstering enterprise creation and private sector development; improving the business climate, strengthening regional integration; reforming the labor market |
| Promoting human development | Rebalancing the healthcare system to reduce the emphasis on hospital-based care and increase integration between levels of care. | Establishing an integrated healthcare system to shift the balance of care towards a patient-focused, preventive and community-based model |
| | Meeting critical needs for a high-quality workforce across the health sector (and affecting other sectors). Raising the achievement of Qatari students at all levels especially in math, science and English and, through that increasing educational attainment. | Developing and implementing a national workforce plan that takes a multifaceted approach and optimizes the skills mix. Strengthening reforms in K–12 and higher education to ease demand and supply constraints |
| | Coordinating education and training providers and aligning with labor force needs. Reducing reliance on low-cost, low-skilled foreign labor. | Addressing quality, efficiency, inclusiveness and portability across the entire education and training systems. Reviewing the sponsorship law and identifying ways of attracting and retaining higher skilled expatriate workers. |
| | Balancing the forces of modernization and globalization with the support of | Implementing cross-cutting measures to strengthen family ties, values and relationships. |

| | | |
|--|--|--|
| Taking an integrated approach to sound social development | traditional Qatari family values and patterns of family formation. | |
| | Improving road safety and ending the growing epidemic of traffic accidents, particularly among youth. | Introducing a holistic approach to road safety, with cross-sectoral partnerships. |
| | Encouraging a more active lifestyle for young people, to reduce the health-related risks of inactivity. | Promoting local sports participation and development as part of a comprehensive, active lifestyle program. |
| Sustaining the environment for future generations | Reforming unsustainable water consumption patterns. | Establishing an integrated water management plan across the value chain. |
| | Encouraging sustainable urbanization and consumption patterns that reduce environmental stresses. | Promoting more sustainable urbanization and a healthier living environment. |
| Developing modern public sector institutions | Strengthening weak institutional capacities. | Strengthening the role of central functions to support institutional development and modernization. |
| | Expanding human resources capacities across the public sector. | Applying policies to attract talent, including staff development program. |
| | Establishing a centralized system for managing for results and for linking resource allocation to strategic plans. | Launching a public sector performance management framework linking institutional performance to strategic plans and budgets. |

4.2 Fields where technologies being used

Technological advances applied to the field of energy, environment, waste management, water resources (desalination), and others. In terms of spatial compactness, it omits the need for intercity transportation in other World Cups such as Russia 2018, which were highly dependent on airline transportation and had high carbon emissions and energy consumption. This compact model also allows fans and participants to be hosted in one place for the whole event or the whole stay at the World Cup, unlike other tournaments, reducing the corresponding expenses and raising the attractiveness of the Cup (GSDP 2008).

4.3 Stadia and infrastructure and carbon neutral

Qatar has eight stadiums built for the World Cup, boasting their sustainable designs and constructions as certified by the Global Sustainability Assessment System (GSAS). After the World Cup, some of these stadiums will be converted into other facilities for local business opportunities. The construction and procurement policies of these stadiums boost local economics and lower carbon emissions from transport. Qatar FIFA 2022 also has a Sustainable Sourcing Code (SSC) in place for working with local and global supply chains (Ganji 2016). Furthermore, Qatar FIFA 2022 states that these stadiums – and other sites and events – are accessible for people with disabilities. The enhancements will be shown in the infrastructure, staff and volunteers, ticketing procedures, and transportation systems. Outside, Qatar is preparing new green spaces around the stadiums and training sites. These parks will have regional plants with low-water consumption and be irrigated with recycled water.

The World Cup 2022 organizers were wise to move the sport event execution to late November/December, thus reducing cooling demands and subsequent energy consumption. Nevertheless, cooling will be needed, but Qatar organizers are emphasizing the application of innovative technologies, leveraging carbon-free technologies such as solar energy (Qatar 2022). Additionally, the stadia are located to grow as future hubs of urban development in diverse neighborhoods of Doha and to be used not only as stadia but such as hotels, malls, and sports centers for soccer and other sports fans. To avoid idle capacity of the stadia, they are built under a modular, detachable design to be used at full capacity during the FIFA World Cup 2022 and then partially dismantled and donated to developing countries, to promote sports and build 22 other stadiums (Scharfenort 2012).

Maybe the most striking and innovative design proposal is the construction of the fully modular Ras Abu About Stadium, which consists of 40,000 seats in the waterfront area, set to be built with steel containers and other prefabricated, recyclable, and dismountable parts, reducing waste materials. Once the World Cup is done, the stadium will be completely dismantled and the materials used for other projects. This stadium is a unique case in World Cup history, that a new construction model for stadia is possible, reducing construction costs, and eliminating operation and maintenance expenses after the 2022 sport event, an overburden cost held by many ex-FIFA World Cup hosts.

There is no doubt that global events create massive carbon emissions. However, World Cup Qatar 2022 promises to be carbon neutral. The strategy includes a four-step process: awareness, measurement, reduction, and offsetting. In reduction, Qatar 2022's plans include renewable energy, energy and water-efficient stadiums, recycled materials usage, and waste management strategies. The final step is to offset the remaining emissions by partnering with the Global Carbon Council.

4.4 Social aspect

On the social side, the organizers are thinking about the development of social capital building initiatives to integrate locals, expatriates, and visitors in a harmonic environment of friendly understanding, respect, and cultural exchange. Qatar is the first Arab country to welcome this huge event in a region such as the Middle East, which is usually portrayed as very conservative and traditional. Although there are differences among the Muslim countries, Qatar is still a traditional country with high respect for the Arab culture and religious behaviors that should be followed by the nationals and respected by the immigrants and visitors. This aspect, in turn, clashes at times with the Western modernity approach that the Qatari government is embracing for future generations, and the immigrants/visitors' lifestyles (Al-Emadi et al. 2016). The World Cup is expected to welcome thousands, if not millions of visitors, with different traditions that could produce some cultural clashes. For instance, such clashes could take place in the celebrations after numerous matches in a festive environment such as the soccer World Cup, with usually high consumption of alcoholic beverages (alcoholic consumption is forbidden in Qatar), which augments sports' passion and feelings. Qatar's challenge is to encourage respect, knowledge, and tolerance for traditions and habits in an environment that facilitates cultural exchange, understanding, awareness, and anti-discrimination, but at the same time, allowing room for the celebration of the event, which is expected to position Qatar in closer contact with the whole world, one of the most outstanding legacies.

Finally, regarding human rights and forced migrant workers' issues, Qatar issued new procedures and mechanisms to control the abusive practices of employers such as non-payment, excessive hours, work under extreme conditions, confiscation of passports, and others (Ganji 2016). Simultaneously, the Qatari government has been trying to improve the workers' accommodation and change immigration mechanisms.

4.5 Environmental aspect

Environmental sustainability priorities most of the eight environmental issues were related to event itself, with a few having a long-term perspective. These included two priorities to ensure compliance of stadiums with green-building standards, and to develop the sustainable management capacities of stadium operators. Three measures related to transport, carbon, energy and waste management: ensuring efficient energy and carbon management during the event; ensuring efficient and sustainable World Cup-related waste management; and minimizing the environmental impact of World Cup-related transport. The last three environmental priorities centered on risk mitigation and biodiversity: mitigating the risks of environmental incidents related to event operations; ensuring compliance between event operations and local regulations governing specially protected sites; and promoting environmental protection and biodiversity in relation to event preparations and staging (Sofotasiou et al. 2015).

4.6 Economic aspect

Compliance with ethical business practices was a top priority, included measures to ensure that commercial affiliates and suppliers complied with FIFA and LOC standards on fair marketing practices and ethics, as well as compliance with resettlement and buyout regulations related to event stadiums. The other economic sustainability dimension was local economic development, and included: supporting investments and infrastructure development in relation to the world cup to promote the economic development of the host country; contributing to world cup-related job creation; and promoting the host country as a tourism destination. While FIFA had taken these impressive steps to institutionalize sustainability in the World Cup management structures and operations, some remained skeptical, and demanded that the organization do more to "prove to the world that its sustainability policies are an irreversible

reaction to global expectation and consciousness for a cleaner, greener world in which future soccer players and children play the 'beautiful game'.¹² One particular concern was that none of the nine criteria used in the technical evaluation of hosting bids was sustainability-focused, although a small proportion (7.5 per cent) of the stadium criteria took sustainability into consideration, and environmental issues were considered in the risk assessment report (Scharfenort 2012). This was considered a missed opportunity to make sustainable practice and legacy a dominant issue from the bidding stage, raised questions about FIFA's level of commitment to sustainability and sustainable development.

4.7 Sustainability legacy

As the Russia World Cup 2018 concluded with France emerging as champions, the world's attention was focused on Qatar World Cup 2022. It was Qatar's turn to shine. FIFA had taken "a bold gamble" in awarding the hosting rights to the small desert kingdom, and it was now time for Qatar to show it could deliver on its promise to organize the best and most sustainable world cup ever. Hosting the sporting mega- event successfully will expand the "soft power" and global clout of the "tiny giant" (Karadakis et al. 2010).

Several labor-related issues required immediate action, as advocacy groups and media had reported numerous cases of systematic human rights abuses, forced labor, human trafficking and indefinite detention of migrant workers. There was a global campaign to abolish the Kafala system of visa sponsorship which many regarded as a modern form of slavery; Qatar was under immense pressure to take action on this decades-long practice that was prevalent in the Arab world. The most serious challenge was construction site safety, as over 1,200 construction workers had died between 2010 and 2013, with the number projected to reach 4,000 by the start of the event. It was time for Qatar to deliver on its promise to create "a true international legacy with no white elephants" (Pruss 2015).

5. Related Studies

The extensive use of cutting-edge technical solutions has significantly increased mega-events success. In recent years, a number of large-scale event planners have used cutting-edge technology solutions to improve audience engagement, event security, and operational effectiveness. There will not be any changes in the Qatar world cup. Qatar has poured much money into technology to ensure that the event runs well and serves as a blueprint for future sizable events (Dorsey 2013).

5.1 Step 1: Listing and filtering the technology

The identification and filtration of the technology utilized in mega events is the first step in this review of the literature. Four basic categories can be used to classify the technology utilized in large-scale events: (1) big data analytics; (2) artificial intelligence, (3) IoT (Internet of Things); and (4) machine learning. It is crucial to comprehend the particular technology utilized in the Qatar World Cup hosting since the technology is employed in each of these categories in different aspects.

World Cup 2022 in Qatar as a Case Study on the influence of social media on event tourism. Aziz and Ali (2019) investigated how social media has affected event tourism, with a particular emphasis on the Qatar. The article discusses the event's utilization of various social media channels and how that has affected tourism. Moreover, understanding fan experience through social media, a study examines the fan experience during the world cup through social media. The paper provides insights into the various social media platforms used during the event and their impact on the fan experience (Liu and Scott 2019).

Dale and Hassanien (2017) offered a paradigm for smart tourism regarding the World Cup in Qatar. The study offers insights into the various smart tourism technologies employed and how they affect event success and fan satisfaction. Furthermore, Kim and Lee (2018) proposed smart tourism technologies and future tourism. Using the FIFA 2022 World Cup as a case study, this article explores how smart tourism technology may influence future vacations. The paper provides insights into the various smart tourism technologies used during the event and their impact on the fan experience.

Assimakopoulos and Kavoura (2018) proposed the function of digital platforms in mega-event management. This essay examines the use of digital platforms in managing major events, with the Qatar 2022 World Cup serving as the primary example. The paper offers details on the numerous digital channels utilized throughout the event and their effect on the event's success. Al-Thani and El-Tawil (2019) addressed that enhance the fan experience through technology, it analyzes the functionality of "smart stadiums," which use a wide range of technological enhancements

to enhance fans' time at matches. This article explores how various smart stadium technologies affect the match that goes at the stadium.

A study suggested enhancing the fan experience through augmented reality. This paper examines the use of augmented reality to enhance the fan experience during the Qatar 2022 World Cup. The paper provides insights into the various augmented reality technologies used during the event and their impact on the fan experience (Nguyen et al. 2019). Park and Kim (2018) explored the use of virtual reality in mega-event management. This paper explores the use of virtual reality in mega-event management, with a specific focus on the world cup and the enhancement of security management.

5.2 Step 2: The impact of technology adoption on the success of an event

The success of big events is influenced both directly and indirectly by the use of technology. The effective management of the event, the drop in operating expenses, and the enhancement of security measures are all direct results of technology use. Due to technology implementation, fan participation, satisfaction, and enjoyment have all increased. In addition, understanding technology's role in achieving mega-events requires looking at its immediate and long-term effects.

5.3 Step 3: Documenting the lessons discovered

The deployment of technology in major events must include documentation of lessons learned. Future major events in the same or different sectors can use the lessons acquired from hosting the FIFA Qatar 2022 World Cup as a guide. To determine if it will be possible to apply the lessons learned in future events, it is critical to evaluate the level of the documentation, which can be characterized for both public-sector and private-sector events (Henderson 2014).

5.4 Step 4: Technological adoption in the public and private sectors

Both the public and commercial sectors have the potential to influence how technology is used during large-scale events. The infrastructure and facilities made available for the event demonstrate the public sector's embrace of technology, while the commercial sector's deployment of technology is evident in ticketing and access control, communication and broadcasting, and fan involvement and experience. Therefore, examining adoption rates and how the public and private sectors have adapted to new technology is crucial.

5.5 Step 5: Creating a questionnaire and finding gaps

Finding the gaps in the current body of knowledge and creating a questionnaire for additional research constitute the review's final step. The technology used to host the Qatar FIFA World Cup 2022 or the implications of technology adoption on event success may be related to the gaps. The questionnaire can be used to conduct surveys or interviews in order to gather information and offer insights regarding the use of technology at large-scale events.

6. Conclusion

In conclusion, embracing new technology is essential for the success of large-scale events. Therefore, it is critical to investigate the technology deployed by Qatar FIFA World Cup. Digital platforms, smart tourism technologies, social media, augmented reality, and virtual reality were found to improve the fan experience, safety and security, and operational efficiency via a study of the relevant literature. The challenges and successes of using these technologies have been chronicled to benefit future organizers of large-scale events. Lastly, the paper lays out a plan for future research on the influence of technology adoption on the success of mega-events, which may be used to inform planning for such events. This research adds significantly to the literature review on technology acceptance at mega-events. It may help shape future policies and strategies for introducing innovative technologies in Qatar for such mega events.

Qatar's transition toward knowledge society is facing serious challenges. These challenges relate to reform and development of education and training to make knowledge as a principal driver of growth, diversification of the economy to ensure endurance of adequate revenues to fund projects, resolve the expatriate and workforce issues to ensure equilibrium and efficiency, efficient management of growth and uncontrolled expansion to avoid duplication of works and waste of resources, good governance across government and private sectors projects to cope with modernization, professionalism and transparency, balancing between modernization and preservation of traditions to respond to globalization without losing the identity, balancing the rights of the present and future generations to uphold justice, and sustain the environment to make it healthy for living.

This study addressed the arrangement of the Qatar 2022 FIFA World Cup as sports mega-events considering sustainability as one essential concept for the organization within the frame of Qatar's National Vision 2030. The main role of this study is to combine the sustainability issues and challenges, new technologies, legacies, motivations, opportunities. This sustainable approach assembled with the legacy vision on the World Cup organization is expected to drive different sectors of development of Qatar, boosting this new emergent country in the Middle East. Other contributions are the systematic analysis and comparison with other sports mega-events, to offer early warnings for additional measures to increase the sustainability level, and to ensure prolonged positive impacts on most if not all stakeholders.

The extensive use of cutting-edge technical solutions has significantly increased mega-events success. In recent years, a number of large-scale event planners have used cutting-edge technology solutions to improve audience engagement, event security, and operational effectiveness. There will not be any changes in the Qatar World Cup. Qatar has poured much money into technology to ensure that the event runs well and serves as a blueprint for future sizable events (Dorsey 2013).

The new approach using a reduced compact spatial model to organize the World Cup into the Doha city, with all the venues within one hour of transportation, allows some reductions in carbon emissions from the World Cup. The leverage of innovative technologies and new construction approaches can be helpful to likewise contribute to energy efficiency, reduction, waste management, and other problems. However, the challenges are also huge, mainly related to using the World Cup as a booster for sustainable development in different relevant economic, environmental, social, and human areas, in a small and arid country of an unforgiving environment. The successful order of the event demonstrates in the short-term, the hard-working and careful organization of the Muslim country in a world-class sports mega-events; in the long-term, it may turn into a future model of sustainable organization and positive contribution to the host country development.

Qatar and FIFA organizers delivered a sustainable strategy related to the World Cup, which explained in more detail the carbon neutrality concept applied to this sports mega-events and the strategies used to operate the achievement of the carbon-neutral target. Socially, it is relevant to see the progress and measure effectiveness on workers' human rights and the integration of the community as an early participant in the organization, leading to more democratic involvement of the civil society, which is due to be impacted by the legacies of the event. Such participation has already ensured a more satisfactory outcome and positive collective memory on other events.

According to the drives that organized the event, Qatar eventually increased its global image and reputation, making it attractive as a new destination for different activities such as business and sports and developing the country socially, humanly, economically, and with respect to the environment, which are the four main pillars envisioned in the Qatar National Vision 2030. The Qatar Supreme Committee for Delivery and Legacy has already released a legacy book, a guideline to the main targets to be achieved after the event. Time will tell if the organizers will be able to translate the Qatar World Cup organization into an effective tool to drive such a vision.

References

- Abdulwahed, M., Office of Strategic Innovation, Entrepreneurship & Economic Development, Available: <https://www.qu.edu.qa/offices/president/sieed>, April 16, 2023.
- Al-Emadi, A., Diop, A., Kaplanidou, K. and Sagas, M., 2022 Qatar World Cup: Impact Perceptions Among Qatar Residents, *Journal of Travel Research*, vol.56, no.5, pp. 13-26, 2016.
- Al-Thani, A. and El-Tawil, S., Smart stadiums: Enhancing the fan experience through technology, *Journal of Engineering, Design and Technology*, vol. 17, no. 4, pp. 657-673, 2019.
- Aziz, A. and Ali, S., The impact of social media on event tourism: A case study of Qatar 2022 World Cup, *Journal of Hospitality and Tourism Management*, vol. 41, pp. 116-125, 2019.
- Bizimungu, N., US can benefit from Qatar's expertise in organising 2026 World Cup: official, *December 4, 2022*, <https://dohanews.co/us-can-benefit-from-qatars-expertise-in-organizing-2026-world-cup-official/>. Accessed April 2, 2023.
- Cornelissen, S., More than a sporting chance? appraising the sport for development legacy of the 2010 FIFA, *Third World Quarterly*, vol. 32, no. 3, pp. 503-529, 2011.
- Death, C., Greening the 2010 FIFA world cup: Environmental sustainability and the mega-event in South Africa, *Journal of Environmental policy and planning*, vol.13, no.2, pp. 99-117, 2011.

- Dorsey, J., Qatar 2022: A Mixed Blessing, Available: https://www.huffpost.com/entry/qatar-2022-a-mixed-blessi_b_3846940, April 5, 2023.
- Dolles, H. and Soderman, S., Addressing ecology and sustainability in mega-sporting events: The 2006 football world cup in Germany, *Journal of Management and Organization*, vol. 16, no. 4, pp. 587-600, 2010.
- Elagouz, N., Onat, N. C., Kucukvar, M., Sen, B., Kutty, A. A., Kagawa, S., Nansai, K. and Kim, D., Rethinking mobility strategies for mega-sporting events: A global multiregional input-output-based hybrid life cycle sustainability assessment of alternative fuel bus technologies, *Sustainable Production and Consumption*, vol. 33, pp. 767–787, 2022.
- FIFA, Semi-automated offside technology to be used at FIFA World Cup 2022, Available: <https://www.fifa.com/technical/media-releases/semi-automated-offside-technology-to-be-used-at-fifa-world-cup-2022-tm>, Accessed on March 20, 2023.
- Ganji, S., Leveraging the World Cup: Mega Sporting Events, Human Rights Risk, and Worker Welfare Reform in Qatar, *Journal on Migration and Human security*, vol. 4, no.4, pp. 221-258, 2016.
- General Secretariat for Development Planning (GSDP), Qatar National Vision 2030, Available: https://www.psa.gov.qa/en/qnv1/Documents/QNV2030_English_v2.pdf, Accessed on March 14, 2023.
- Grez, M., History made as VAR used for first time in World Cup match, August 8, 2018, <https://edition.cnn.com/2018/06/16/football/france-australia-world-cup-russia-2018/index.html>. Accessed April 8, 2023.
- Government communication office, Qatar National Vision 2030, Available: <https://www.gco.gov.qa/wp-content/uploads/2016/09/GCO-QNV-English.pdf>, Accessed on March 20, 2023.
- Hassanien, A. and Dale, C., Smart tourism: A framework for Qatar 2022 World Cup, *Tourism Management Perspectives*, vol. 22, pp. 26-31, 2017.
- Hayajneh, A., Elbarrawy, H., El Shazly, Y. and Rashid, T., Football and Sustainability in the Desert, Qatar 2022 Green World Cup's Stadiums: Legal Perspective, *European Journal of Social Sciences*, vol. 55, no. 4, pp. 475- 493, 2017.
- Henderson, J. C., Hosting the 2022 FIFA World Cup: Opportunities and challenges for Qatar, *Journal of Sport & Tourism*, vol. 19, no. 3, pp. 281-298, 2014.
- Karadakis, K., Kaplanidou, K. and Karlis, G., Event leveraging of mega sport events: a SWOT analysis approach, *International Journal of Event and Festival Management*, vol. 1, no. 3, pp. 170-185, 2010.
- Kavoura, A. and Assimakopoulos, C., The role of digital platforms in mega-event management: The case of Qatar 2022 World Cup, *Journal of Place Management and Development*, vol. 11, no.1, pp. 39-56, 2018.
- Kim, H., Choe, Y., Kim, D. and Kim, J., For Sustainable Benefits and Legacies of Mega-Events: A Case Study of the 2018 PyeongChang Winter Olympics from the Perspective of the Volunteer Co-Creators, *Sustainability*, vol. 11, no. 9, 2019.
- Kim, S. S. and Lee, S. Y., Smart tourism technologies and future tourism experience: Implications for Qatar 2022 World Cup, *Journal of Travel Research*, vol. 57, no.8, pp.1059-1073, 2018.
- Konrad-Adenauer-Stiftung, Sustainable mega-events in developing countries: Experiences and insights from host Cities in South Africa, India and Brazil. Science Port, Available: https://www.researchgate.net/publication/341179734_Sustainable_megaevents_in_developing_countries_Experiences_and_insights_from_host_Cities_in_South_Africa_India_and_Brazil, Accessed on March 12, 2023.
- Lemire, J., Players at FIFA World Cup Will Be Able to Access Individual Performance Data, Insights Through New App, Available: <https://www.sportsbusinessjournal.com/Daily/Issues/2022/09/23/Technology/fifa-world-cup-qatar-new-app-performance-data>, March 12, 2023.
- Liu, D. and Scott, N., Understanding fan experience through social media: The case of Qatar 2022 World Cup, *Journal of Destination Marketing & Management*, vol. 11, pp. 77-85, 2019.
- Nguyen, D. T., Nguyen, T. T. H. and Nguyen, T. T. N., Enhancing the fan experience through augmented reality: The case of Qatar 2022 World Cup, *Journal of Travel & Tourism Marketing*, vol.36, no.6, pp. 672-684, 2019.
- Park, S. Y. and Kim, Y. K., Exploring the use of virtual reality in mega-event management: The case of Qatar 2022 World Cup, *Journal of Convention & Event Tourism*, vol. 19, no. 3, pp. 173-184, 2018.
- Preuss, H., The Contribution of the FIFA World Cup and the Olympic Games to Green Economy, *Sustainability*, vol.5, no. 8, pp. 3581-3600, 2013.
- Preuss, H. (2015). A framework for identifying the legacies of a mega sport event, *Leisure Studies*, vol. 34, no. 6, pp. 1-22, 2015.
- Qatar 2022, Vision Mission & Values, Available: <https://www.qatar2022.qa/>, Accessed on March 3, 2023.

- Qatar Foundation, Cooling technology used in Qatar's World Cup stadiums powered by QF research, Available: <http://www.qf.org.qa/stories/cooling-technology-used-in-qatars-world-cup-stadiums-powered-by-qf-research>, Accessed on March 1, 2023.
- Qatar sports tech, Who is Qatar SportsTech , Available: <https://qatarsportstech.com/>, Accessed on April 06, 2023.
- Rago, V., Brito, J., Figueiredo, P., Costa, J., Barreira, D., Krstrup, P. and Rebelo, A., Methods to collect and interpret external training load using microtechnology incorporating GPS in professional football: a systematic review, *Research in Sports Medicine*, vol.28, no.3, pp. 437–458, 2020.
- Regret Iyer, S., Pavlik, J. and Jin, S. V., Leveraging virtual reality (VR) for sports public relations and sports journalism: qualitative analyses of VR content productions for 'Russia 2018' and 'Qatar 2022' FIFA World Cups, *Journal of Sport & Tourism*, vol.26, no.4, pp. 335–362, 2022.
- Saleem, F., QSTP makes positive impact on country's tech ecosystem in 2022, January 6, 2023, <https://thepeninsulaqatar.com/article/06/01/2023/qstp-makes-positive-impact-on-countrys-tech-ecosystem-in-2022>, Accessed March 29, 2023.
- Scharfenort, N., Urban Development and Social Change in Qatar: The Qatar National Vision 2030 and the 2022 FIFA World Cup, *Journal of Arabian Studies*, Vol. 2, no.2 , pp. 209-230, 2012.
- Sofotasiou, P., Hughes, B. and Calautit, J., Qatar 2022: Facing the FIFA World Cup climatic and legacy challenges, *Sustainable Cities and Society*, vol. 14, 16-30, 2015.
- SPF, ASPIRE Control & Command Center, Available: <https://spfconsoles.com/fifa-world-cup-qatar-2022-command-center/>, Accessed on May 1, 2023.

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