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Innovation Diffusion in the Sustainable Design of Sport Venues

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In 2022, architect Pouria Babakhani released a series of forward-looking digital renderings that visualized London's football stadiums of the future (Babakhani, 2022). Produced using AI-based image generator Midjourney, most of the designs significantly deviate from those of modern venues. In one case, for example, a disc-shaped "roof" casts a shadow on the ground from above, unattached from the rest of the stadium bowl; in another, the stadium's seating areas and support structures rise directly out of a lake. Interestingly, a pair of stadiums in the collection stand out not because of their atypical designs but rather for their similarities with recently constructed venues in Las Vegas. In the first, the conceptual stadium's all-black color scheme, glass walls, and circular, translucent roof collectively share a likeness with the features of Allegiant Stadium, home of the Raiders. In a second Babakhani stadium, a colossal, football-shaped orb rises above several ringed concourse levels (see Figure 1), and although it is undeniably distinct from every other sports facility today, it does bear some resemblance to the \$2.3 billion Sphere at The Venetian, the entertainment venue that opened in September 2023 in Las Vegas (Velotta, 2023).

In a similar exercise conducted several years earlier, *National Geographic* partnered with stadium architecture firm Populous (whose credits include Sphere) to design a "Stadium of Tomorrow" (Treat et al., 2017). The stadium featured a wide range of imaginative features, including drones that delivered food and beverage directly to a spectator's seat, self-propelled hospitality "pods" that could move with the action, and transparent fields that would enable spectators to follow the game from below. A central focus of the project was on making the venue a self-sufficient ecosystem with wind turbines, solar arrays, rainwater collectors, and vegetable gardens. Similar to Babakhani's project, many of the concepts pro-

posed in the Stadium of Tomorrow seemed fantastical and unlikely to occur in at least a lifetime. Yet other features already exist today, particularly those associated with environmentally sustainable design. In the near decade since we first wrote about the adoption and diffusion of pro-environmental stadium design (Kellison & Hong, 2015), numerous technological, economic, and industry advances have enabled further growth. In this paper, we discuss the current state of innovation diffusion in sustainable design among sport's professional arenas, ballparks, and stadiums. We begin with a review of the diffusion of innovation theory before discussing its application to sport facility design and operations.

Figure 1

Example From Pouria Babakhani's "The New Soccer Stadium of London" Project



Note. © Pouria Babakhani. All rights reserved and included with permission.

Innovation Diffusion in Context

Innovation diffusion is the process by which a new idea, technology, product, or practice spreads through a population or a social system over time. It describes how innovations are adopted and accepted by different individuals or groups within a society. The concept was introduced by sociologist Everett Rogers in his book *Diffusion of Innovations*, first published in 1962. Rogers' (2003) diffusion of innovation theory has served as a fundamental theoretical base of innovation adoption and diffusion research in various disciplines including sport management (Gopalakrishnan & Damanpour, 1997; Premkumar & Ramamurthy, 1995).

Rogers (2003) defined innovation as “an idea, practice, or object that is perceived as new by an individual or unit of adoption” (p. 2). Meanwhile, at the organizational level, Damanpour and Evan (1984) defined innovation as “the implementation of an idea—whether pertaining to a device, system, process, policy, program, or service—that is new to the organization at the time of adoption” (p. 393). This definition indicates whether its origin has been internally generated, borrowed from outside, or already used by other organizations in the same social structure, innovation should be new to the organization when it is implemented (Damanpour, 1987). Diffusion can be described as

the process by which the adoption of innovation by member(s) of a social system is communicated through certain channels and over time triggers mechanisms that increase the probability of its adoption by other members who have not yet adopted it. (Rogers, 2003, p. 20)

Hence, diffusion may be useful for explaining why some firms or state and local governments adopt innovation far ahead of others; it may also be used as one possible explanation for innovation adoption. Rogers characterized adoption as “a decision to make full use of an innovation as the best course of action available” (p. 177). In his theory, adoption is an event in the diffusion process, termed as the innovation-decision process, and thus, diffusion is composed of individual adoption (Straub, 2009). Furthermore, Rogers differentiated the adoption process from the diffusion process in that the diffusion process occurs within a population over time, whereas the adoption process pertains to an individual. In other words, adoption is a subprocess of diffusion.

An organization's level of innovativeness may be classified as (a) innovator, (b) early adopter, (c) early majority, (d) late majority, or (e) laggard. First, innovators tend to be venturesome and unafraid of risk. They can cope with a higher level of uncertainty relative to their peers. Second, early adopters tend to be open to change but not as risky in their adoption as the innovators. Third, members of the early majority, which usually represent one third of all members of a system, adopt innovative ideas somewhat earlier than the average member of a system. They tend to follow with more deliberateness in the decision-process to adopt an innovation, but they seldom lead. Fourth, the late majority, usually consisting of another one third of the system, adopts innovations after the average member of a system. Due to their skepticism about innovations, they tend to accept innovations once most others in their system have already adopted them. Thus, in their decision-making process, the pressure of peers and the weight of system norms are primary motivators in the adoption process. Finally, laggards possess traditional views and almost no opinion leadership.

Considering these characteristics, decision makers tend to act only after first observing successful consequences of innovation by other members of the social system, resulting in a long innovation-decision period.

Out of the vast scholarship on innovation, one line of inquiry focuses on what causes organizations to adopt innovations. Studies in this space have used two distinct perspectives to analyze organizational innovation: the adoption perspective and the diffusion perspective (Kimberly & Evanisko, 1981). According to Kimberly and Evanisko (1981), the adoption perspective addresses “what makes an organization responsive to change in its environment,” while the diffusion perspective addresses “why and how an innovation—or group of innovations—spread in a population” (p. 85).

Recently, more innovation adoption and diffusion research has been observed in the sport management literature. Hoeber and Hoeber (2012) identified three determinant categories (i.e., managerial, organizational, environmental) through interviews, focus groups, and observations. They found that leadership commitment, pro-innovation characteristics, organizational capacity, straightforward organizational structure, and engaged and interested external stakeholders were the most pivotal determinants throughout the innovation process. Hong et al. (2015) proposed a conceptual framework of professional sports stadium construction adoption using Rogers’ diffusion of innovation theory, and Berry and Berry’s unified theory of policy innovation. The proposed conceptual framework identified the determinants of the adoption of new stadium construction from professional sport team and government perspectives. Based on this proposed framework, Hong et al. (2019) empirically tested the determinants influencing Major League Baseball’s (MLB) new stadium construction employing event history analysis. Surprisingly, the results revealed that the most influential determinants were diffusion effects, measured as divisional diffusion and regional diffusion.

Innovation in Sport Sustainability

Returning to the subject of sport sustainability, in our earlier work, we examined the key factors contributing to the decision to adopt pro-environmental stadium designs and found that economic savings were the primary reason to adopt environmentally friendly stadium design (Kellison & Hong, 2015). That study was conducted in the context of venues earning the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) certification, which still plays a prominent role in recognizing sport stadiums built with pro-environmental features. For new facilities, those meeting prerequisites and accumulating sufficient credits in various categories such as location, transportation, sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation can attain certifications ranging from Certified to Silver, Gold, or Platinum. Since 2008, 35 facilities across MLB, Major League Soccer (MLS), the National Basketball Association (NBA), the National Football League (NFL), and the National Hockey League (NHL) have been LEED certified (Center for Sport and Urban Policy, 2023).

However, it is important to note that these rating systems, although important for publicly acknowledging stadiums with eco-friendly designs, offer only a partial perspective. Some stadiums may have the infrastructure in place to reduce their events’ environmental impact, but these systems are only

as effective as a building's managers and operations staff. Inadequate waste management strategies, superficial energy audits, or insufficient training of janitorial staff can undermine the sustainability of a well-designed structure. To address this potential issue, some rating systems—including LEED (through its O+M rating platform)—have extended their scope beyond a venue's design to also include its operation and maintenance. Outside North America, alternative systems have been adopted to evaluate and recognize environmentally friendly stadiums and events. They include the Building Research Establishment's BREEAM assessment, which has certified events including those used during the 2012 Olympic and Paralympic Games in London and the 2018 FIFA Men's World Cup in Russia (Paterson, 2011; Russian Green Building Council, 2016). Another certification tool, the International Organization for Standardization's ISO 20121, emerged from the 2012 London Games and has since "become one of the sustainability requirements for every Olympic Games" (International Olympic Committee, 2023, para. 6). In the years that followed the London Games, Rio 2016, PyeongChang 2018, Tokyo 2020, Beijing 2022, and Paris 2024 have all been certified.

The 2022 FIFA Men's World Cup in Qatar used a domestic green-building rating system called the Global Sustainability Assessment System to evaluate its venues across the entire building lifecycle, including project planning, concept design, detailed design, construction, and operation and maintenance (Gulf Organization for Research & Development, 2023). Like other mega-events, the World Cup affords a host nation the opportunity to display before a global audience its cultural attributes, its attractiveness as an international destination, and its commitment to environmental sustainability (Kaplanidou et al., 2012). As Hassan Al Thawadi, Secretary General of Qatar's Supreme Committee for Delivery and Legacy, acknowledged, "Hosting the first FIFA World Cup in the Middle East and Arab world is an unmatched opportunity for our country and region. In line with Qatar's development goals, it is an opportunity to showcase an unwavering commitment to sustainability" (Supreme Committee for Delivery and Legacy, n.d., p. 2).

Elsewhere, other certification systems have emerged that can be more narrowly applied to specific aspects of building design and operations. For instance, the Total Resource Use and Efficiency (TRUE) credential focuses on the management of venue materials and waste, a certification recently achieved by Atlanta's Mercedes-Benz Stadium for its 90.2% diversion rate (Byrne, 2023). The continued proliferation of these rating systems and their gaining precision and customizability toward sport events and facilities reflect an industry appetite for these public markers of success. They also reflect a growing desire to quantify what it means to be "sustainable," measure environmental performance, and demonstrate that organizations are meeting their environmental goals.

In a recent study, Wanless et al. (2023) analyzed the use of renewable energy sources (i.e., solar, wind, water, biomass, fuel cell, geothermal) among North American professional sports stadiums, and, based on the current rate of diffusion, predicted "full diffusion of facilities adopting at least one renewable energy source" (p. 27) would occur in 2061. But, as they acknowledged, numerous factors could shorten or lengthen the time needed for full diffusion to occur, including increasing cost competitiveness with fossil fuels, long-term cost stability, technological advances, legislative action, and continued consumer demand.

There are numerous signals that some of the underlying mechanisms for industrywide innovation diffusion are already in place. First, in recent years, there has been an uptick in professional positions in which the primary responsibility is to reduce a stadium or event's environmental impact (Orr et al., 2023). Of course, there are numerous examples of early adopters in employing individuals who oversee their organizations' environmental program (e.g., Atlanta Hawks, Philadelphia Eagles, Lord's Cricket Ground, the NHL), but the emergence of this position as a standard front office role is necessary to effectively plan, implement, and audit a venue's environmental performance. Similarly, the growth in consultancies specializing in sport sustainability (e.g., Phase 3 Sports, Honeycomb Strategies) has complemented organizations' existing staff or provided supplemental expertise in the absence of sustainability coordinators within an organization. Additionally, the consistent success and popularity of annual gatherings of sport sustainability professionals like the Green Sports Alliance and Sport Positive summits suggest the steady presence of industry professionals committed to environmental sustainability. These meetings are regularly attended by individuals representing a wide range of the sport sector, including startups, vendors, media members, athletes, college and professional teams and leagues, and delegates from international bodies like FIFA and the International Olympic Committee.

In recent years, Sport Positive has produced a new level of public accountability by compiling and publishing annual environmental performance rankings for each club in the Premier League, English Football League (EFL), Bundesliga, and Ligue 1 (Sport Positive Leagues, 2023). In the latest EFL rankings, the top performing club was Forest Green Rovers F.C. (FGR), known colloquially as the "greenest football club in the world." Recognizing the impressive scores of several other EFL clubs, FGR owner and chairman Dale Vince offered anecdotal support that the innovation diffusion process is clearly underway: "Ten years ago we were a lone voice with a radical idea, today it's fast becoming normal" (as cited in Lockwood, 2013, para. 1). Although many of these venues' sustainable designs exist within unseen, back-of-house systems (Kellison & McCullough, 2016), some sport organizations like FGR are placing their environmental commitment front-and-center, embedding it in their core mission and engaging in marketing campaigns that explicitly express this commitment to fans, sponsors, and other stakeholders (Trail & McCullough, 2020, 2021).

Collectively, these trends demonstrate the potential for continued growth and transformation in sustainable sport venue design. The adoption and diffusion of sustainable venue design are driven by various factors, including the commitment of early adopters and their endorsement of industry building standards set through systems like LEED and TRUE. Looking forward, the trajectory of innovation diffusion in sustainable sport venue design appears promising. The emergence of dedicated sustainability roles within sport organizations, the growth of sustainability consultancies, and the success of industry gatherings like the Green Sports Alliance and Sport Positive summits all point to a shared commitment to environmental responsibility within the sport sector. Notably, clubs like FGR have demonstrated a necessary condition for the innovation diffusion process in that what was once considered radical activism is now becoming commonplace.

Moving forward, researchers may take several different directions of inquiry. At least one path would approach the innovation diffusion process from an interdisciplinary lens. From a sport management perspective, much of the existing scholarship has focused on the decision making that occurs within sport

organizations by owners and front-office executives. However, as Wanless et al. (2023), McCullough et al. (2023), and others have argued, many of the actors that motivate the sustainable design and operations of sport venues originate outside the organization. These influencers range from community members and fans to policymakers, regulators, and energy providers. In consideration of the latter groups, tapping into the expertise of political scientists, urban planners, and environmental engineers could improve our understanding of the ways in which external forces promote or prevent innovation diffusion.

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