

CONSIDERING THE SOCIAL IMPACT OF SUSTAINABLE STADIUM DESIGN

Timothy B. Kellison

University of Florida
email: tkellison@ufl.edu

Sylvia Trendafilova

University of Tennessee
email: sylviat@utk.edu

Brian P. McCullough

Seattle University
email: mccullb@seattleu.edu

ABSTRACT

As the environmental movement continues to grow steadily around the world, sports organizations are facing an increasing number of calls to reduce the negative impacts of their facilities and events on the natural environment. Given the wide popularity of professional sport across cultures, the adoption of pro-environmental initiatives by prominent teams also has the potential to inspire positive social change among spectators and fans. For organizations, perhaps the most visible symbol of environmental stewardship is the construction (or retrofitting) of pro-environmental arenas, ballparks, and stadiums. Despite their growing popularity, eco-friendly sports facilities represent less than 40% of new stadium constructions in North America, a figure likely to disappoint environmental activists. To provide insight into the decision to adopt pro-environmental facility designs, we investigated the link between social change and sustainable design. Interviews with 13 stadium architects revealed the broad environmental movement has influenced decision-making in sport, and vice versa to a lesser extent. This general consensus could empower advocates hoping to persuade owners to adopt sustainable facility designs in the future. In addition to in-depth analysis of the interviewees' testimonies, implications and directions for future research are provided.

KEYWORDS

Environmentalism; Stadium construction; Social movements

Major sports arenas, ballparks, and stadiums consume massive amounts of nonrenewable energy and have historically placed significant burdens on their cities' public utilities. In the United States alone, physical facilities consume 14% of the nation's potable water and are responsible for 30% of waste output, 40% of raw materials use, 38% of carbon dioxide emissions, 24-to-50% of energy use, and 72% of electricity consumption (U.S. Green Building Council, 2011a). As public

calls for economic and environmental stewardship have increased in recent years, many sports teams have begun adopting pro-environmental initiatives related to facility operations and management. According to Marquette University's National Sports Law Institute (2013), over 80 teams across MLB, the NBA, the NFL, the NHL, and the WNBA have various forms of sustainability initiatives. Additionally, more than 40 major sports facilities have been recognized for sustainable designs by the U.S. Green Building Council since their certification program began in 2008 (Kellison, 2014). Recycling programs, in-stadium signage, and *green game* promotions all serve not only to reduce waste at sporting events, but also to educate spectators about ways in which individuals can adopt sustainable measures at home (Casper, Pfahl, & McCullough, 2014). Support of these initiatives may be attributed in part to the belief that sports organizations' continued attention on the environment may inspire the public to adopt eco-friendly practices in their daily lives (Kellison & Kim, 2014).

Sport has long been championed as a powerful instrument for change; particularly at the professional and international levels, sport has been used to promote active living, foster diplomatic relations among opposing states, and stimulate education and economic programs in developing nations (e.g., García, 2012; Hayhurst, 2009; Nelson et al., 2011). In a 2000 address delivered before the United Nations General Assembly, then-Deputy Secretary-General Louise Fréchette acknowledged sport's transformative nature:

The power of sports is far more than symbolic. You are the engines of economic growth. You are a force for gender equality. You can bring youth and others in from the margins, strengthening the social fabric. You can promote communication and help heal the divisions between peoples, communities and entire nations. You can set an example of fair play. (United Nations, 2000, p. 2)

This view is shared widely by groups throughout the sport management domain, including industry leaders (Beyond Sport, 2014), policymakers (e.g., Obama, 2009), writers and reporters (e.g., Zirin, 2009), and academics (e.g., Welty Peachey, Cunningham, Lyras, Cohen, & Bruening, 2015).

In recent years, one way in which many have suggested that the sport industry might have a significant impact on a growing social movement is by participating in pro-environmental initiatives (Natural Resources Defense Council, 2013). Despite the momentum for sustainable *programming* (Casper et al., 2014), the adoption of green *design* principles lags behind. Based on objective facility-certification metrics, less than 40% of new professional sports stadiums constructed from 2006–2013 integrated major sustainable designs (Kellison, 2014). Team owners and other chief decision-makers may be reluctant to adopt large-scale sustainable measures due to perceived cost barriers (Kellison & Hong, 2015). Based on estimated cost premiums for green buildings (Nyikos, Thal, Hicks, & Leach, 2012) and the average costs of MLB, NBA, NFL, and NHL venues from 2000–2013 (Long, 2013), the added cost of sustainable technology in professional sports stadium design is estimated to be about \$16.4 million per facility. Given this substantial expense, owners intent on demonstrating their teams' environmental stewardship may prefer less costly options such as recycling programs or local food sourcing.

For those seeking to increase the wholesale adoption of eco-friendly stadium design principles, the relatively low rate of adoption by professional sports teams is troublesome. Continued reluctance by team ownership to support green building may slow momentum of the current environmental movement in sport. Thus, the purpose of this study is to examine the connection between the (albeit slow) rise in pro-environmental stadium design and the current environmental movement. For people interested in promoting pro-environmental behavior—including policymakers, environmental activists, and ordinary citizens—understanding the link between green building and social change is important if they are to play any role during conversations about whether a green stadium should be built. By recognizing whether early adopters of sustainable stadium design acted in response to an existing wave of social change or if they expected to galvanize others to adopt sustainable initiatives, environmental advocates can select the most effective course of action for increasing the population of green-certified stadiums throughout professional sport. For example, if a larger social movement is driving sustainable design in sport, activists could promote the benefits of a team’s alignment with emerging standards (Kellison & Mondello, 2012). On the contrary, if the rise in sustainable stadium design is shown to have preceded social change, prospective green builders might be persuaded by the positive reviews early adopters have enjoyed for their social marketing initiatives (Kellison & Kim, 2014). In the sections that follow, we consider these possibilities in further depth.

LITERATURE REVIEW

Research on sport, social change, and the environment has been extensive and gone in many different directions, as illustrated in the sections below. First, we highlight the myriad ways in which sport has been used as a tool for positive social change. Then, we look at the current strategies of sport organizations engaged in pro-environmental initiatives. As this review will demonstrate, sport organizations are uniquely positioned to bring about change; however, when it comes to issues of the environment, it remains unclear if teams engage in green building as a response to existing social pressure or to catalyze a new wave of environmental stewardship.

Sport as a Vehicle for Social Change

In response to mounting evidence that sport and social change are linked, the number of social institutions designed to exploit this connection has steadily grown over the past two decades. For instance, the UN’s *Sport for Development and Peace* initiative has led the way to utilizing sport as a tool for humanitarian, development, and peace-building efforts (United Nations, 2014). Other international organizations involved in these efforts include the International Olympic Committee (IOC), the Fédération Internationale de Football Association (FIFA), and various national governing bodies. In 2005, FIFA published a document entitled “Football for Hope: Football’s Commitment to Social Development” in which the organization clearly stated its commitment to build a solid bridge between development and football (FIFA, 2014a); since the program’s launch, more than 250 development programs across 60-plus countries have received support (FIFA, 2014b). Elsewhere, *Street Soccer USA* uses sport to build a sense of community between different social groups and foster social inclusion (Peachey, Cohen, Borland, & Lyras, 2011). Outcomes of all these efforts range from educational programs for responsible sexual behavior through community social cohesion to achieving peace at regional and international levels. Below, the link between sport and social change is demonstrated further.

Sport as an Educational Tool

Research has shown that sport-based programs can facilitate educational attainment, especially for young participants. As discussed by Danish and Nellen (1997), youth sport participants can learn different life skills and enhance competencies, including “the abilities to perform under pressure, solve problems, meet deadlines and challenges, set goals, communicate, [and] handle both success and failure” (p. 103). Similarly, in Holt and colleagues’ (2008) study of youth involvement in soccer, they concluded that although participation was not directly correlated to learning life skills, the environment created by coaches could provide opportunities for young athletes to demonstrate leadership and to produce their own teamwork experiences.

Sport organizations around the world are promoting sport as a vehicle for education. The IOC has established the Olympic Solidarity Commission with the aim of using sport not only as a training tool, but as an educational tool as well (International Olympic Committee, 2013a). The commission has a quadrennial budget of US\$438 million, a portion of which is used for various educational initiatives such as programs to further the education of sport administrators, coaches, and sport medicine personnel. Between 2009–2012, the commission awarded more than 1,500 scholarships, offered over 900 technical courses for coaches, and provided nearly 500 management courses for administrators (International Olympic Committee, 2012). Similarly, Manchester United has partnered with UNICEF in an effort to raise financial resources to support the education and welfare of vulnerable children around the world (Levermore, 2008). Since 2000, the United for UNICEF alliance has raised more than £3 million and reached over 3.4 million children (Manchester United Foundation, 2014). In the cases of both the Olympic Solidarity Commission and Manchester United, their financial support has mobilized educational efforts around the globe.

Promoting Health through Sport

Similar to its role in education, sport promotes a lifelong commitment to physical activity. In the US, several initiatives have been introduced to reverse the high rates of physical inactivity among American youths and adults. One such enterprise, the Aspen Institute’s Sport and Society Program, has championed initiatives aimed at increasing access to youth sports for underserved populations and developing physical literacy among children (University of Florida Sport Policy and Research Collaborative, 2013). A foundation for these types of programs is the need for play, recreation, and organized sport, all of which serve as catalysts for forming enduring commitments to healthy living (Aspen Institute, 2014).

Particularly in the area of public green spaces, sport and healthy living can be linked to issues of the environment. For example, a recent focus of the Sport and Society Program is the rise in privatized recreation and the decrease in safe and accessible play spaces for youth in urban, suburban, and rural communities. These changes come at a time when federal and local governments in the US have opened public lands for natural resource exploration and extraction. Consequently, hydraulic fracturing wells dug in or near parks and recreation spaces across the country have impacted wildlife and created aesthetic changes (National Parks Conservation Association, 2013), though the extent—if any—to which visitor activity has been impacted remains unknown.

Outside of the US, Lindsey and Banda (2010) studied the use of sport as a forum for HIV/AIDS prevention in Zambia and pointed out the importance of forming partnerships in order to maximize the reach of educational messages. For example, the Kicking AIDS Out network, a coalition of 22 organizations around the world, was established in Kenya in 2011 to teach personal health and sexual responsibility through sport (Kicking AIDS Out, 2014). More specifically, their goals are to raise awareness about HIV and AIDS and to motivate positive behavior in youth by enhancing their knowledge and practical skills about how to live healthy lives. Similarly, FIFA, in collaboration with the English Football Association, encourages sport participation in underdeveloped countries by assisting in the development of sport infrastructure as a way to improve health in these regions (Levermore, 2008). Another example is *Right to Play*, a global organization working with more than 20 countries, using the power of sport to educate and empower children to overcome the effects of poverty and disease in disadvantaged communities around the world (Right to Play, 2014). In addition to improving physical health, sport has also been linked to enhanced psychological health (World Health Organization, 2003).

Sport as a Diplomatic Tool

Sport has also been used as a tool for diplomacy. As Goldberg (2000) pointed out, “as early as the first Olympic festival in 776 B.C.E., the Greeks viewed sports as a vehicle to unify the civilized world in spite of political differences” (p. 64). Although contemporary sport is often associated with political tensions, it is still used as a tool for conflict resolution and diplomatic purposes, as well as in political movements (Baker, 1988; Bloomfield, 2003; Gasser & Levinsen, 2004; Sugden, 2006).

Sport can facilitate cooperation, bridge differences, and confine conflicts. There is growing evidence that sport can play a positive role in international relations (Peppard & Riordan, 1993). For example, sport provided a vehicle for cultural diplomacy and played a major role in ensuring that South Africa hosted the 2010 FIFA World Cup (Ndlovu, 2010). Merkel (2008) studied the use of sport as a tool for diplomatic dialogue between South and North Korea and noted the achieved improvements leading to soccer players from both countries carrying a unified flag at the World Cup in 2002.

There also have been cases of individual athletes engaging in political activism (e.g., Muhammad Ali, Carlos Delgado). Kaufman and Wolff (2010) conducted interviews with 21 athletes who had been involved in political activism and discovered that four dimensions of sport played a role in progressive social change: social consciousness, meritocracy, responsible citizenship, and interdependency. In the future, sport diplomacy is expected to continue to play a role in foreign policy, helping hostile nations negotiate their differences in a peaceful manner, and in advancing global integration and cooperation.

Sport as a Platform for Environmental Awareness

Central to this study, the connection between sport and environmental awareness dates back to the 1994 Olympic Games in Lillehammer, where, for the first time, close attention was paid to the construction of sport facilities and their effects on the environment (Trendafilova, Bemiller, & Hardin, 2012). Following the success of the 1994 Olympics, the IOC adopted the environment as the third pillar of Olympism and required bidding cities to provide specific guidelines as to how

they would protect the environment during the construction and staging of the Games (International Olympic Committee, 2014). Additionally, in 1994, the United Nations Environment Programme established its *Sports and Environment* initiative to promote environmental awareness through sport.

Much of the attention on using major professional and international sport to promote social change is based on the large captive audiences these events attract. That is, sport events draw a large number of spectators and can serve as a platform to raise environmental awareness (Schmidt, 2006). As Ioakimidis pointed out, "due to their unique relationships to their customers, sport organizations are positioned to become leaders in creating environmental awareness" (2007, p. 2). Inoue and Kent (2012a) studied professional sport teams as promoters of pro-environmental behavior and concluded that positive environmental practices by the team led to increased intentions to engaging in pro-environmental behavior in consumers' own lives. Similarly, in another study, environmental credibility of the team was found to have a positive association with consumer pro-environmental behavior measured by daily recycling and recycling intentions during home games (Inoue & Kent, 2012b). Due, in part, to rising interest in sustainable initiatives, sport organizations are becoming increasingly active in environmental issues, as discussed further in the next section.

Strategic Environmental Initiatives in Sport

In an effort to promote their commitments to the environment, a number of sport organizations have created campaigns that showcase their green initiatives. Additionally, sport managers have taken strategic approaches to raise environmental awareness among sport spectators and community members (Pfahl, 2010). These strategies include forming internal, cross-functional sustainability teams and using them to develop environmental vision and mission statements, budget for facility retrofitting, create sustainability team policies, conduct audits of environmental practices and initiatives, and provide facility tours to the general public. The commitment to environmental sustainability is not a standalone effort, but rather a long-term pledge. It is imperative that a strategic plan be in place in order to gain legitimacy and earn the trust of sport spectators (Inoue & Kent, 2012a). A strategic approach can benefit sport organizations to better leverage these initiatives to maximize exposure and awareness of multiple stakeholder groups (e.g., employees, sponsors, fans, community members) (McCullough & Cunningham, 2010; Pfahl, 2010). Sport organizations at the collegiate and professional levels have leveraged these programs in three primary areas: visible initiatives (e.g., recycling and composting bins), communication and reporting (e.g., website space), and educational programs or interventions in order to influence awareness and behaviors of stakeholder groups.

The most common way for sport organizations to leverage their environmental initiatives is to provide visible examples of the organization's efforts. Recycling and composting bins are perhaps the most commonly used tool to create awareness (McCullough, 2013). Not only do these bins minimize a sporting event's environmental impact on landfill waste, but they can also serve as a common way to demonstrate initial steps toward becoming an environmentally friendly organization. Previous research demonstrates that increased awareness of environmental issues among individuals leads to an increase in environmental behaviors (Davies, Foxall, & Pallister, 2002; McCullough & Cunningham, 2011). Further, McCullough (2013) noted that physical signage

can help fans visualize the effort that the sport organization has taken to improve its environmental standing and give the spectators an opportunity to participate in environmentally sustainable behaviors potentially leading to positive habitual behaviors.

Beyond the visibility of these efforts, sport organizations can then demonstrate the effectiveness or results of environmental initiatives through reporting and communications. Ciletti, Lanasa, Ramos, Luchs, and Lou (2010) found that sport organizations in all leagues were communicating environmental sustainability in some way through their website—33% on home pages and 50% on pages other than the home page. For example, the Philadelphia Eagles have a link to their “Go Green” webpage, which provides an executive summary of their expansive sustainability efforts for the previous year. Likewise, The Ohio State University’s sustainability office, in conjunction with the athletic department, reports and provides further information concerning the zero-waste efforts at Ohio Stadium on the campus sustainability and athletic websites (The Ohio State University, 2013). These website communications are effective in conveying the efforts, avoiding greenwashing accusations, earning credibility among environmental groups and community members. Reporting and conveying credibility allows for fans to *buy in* to the organization’s environmental efforts because the team appears more authentic (Inoue & Kent, 2012a). The buy-in from fans can be furthered through direct interaction between the organization and spectators.

To capitalize on direct contact, sport organizations have begun to directly engage spectators as strategy moves beyond implementation of environmental programs to influencing behavior. Sport organizations can leverage fan identification to influence sport spectators’ event behaviors and everyday behaviors (Casper et al., 2014; Inoue & Kent, 2012a; McCullough, 2013). Casper and colleagues noted that sporting events are non-threatening and nonpolitical events, thereby offering a platform to engage and educate fans on environmental sustainability issues and encourage sport event and everyday behaviors. Educational interventions such as *green games* can inform fans on recycling, green tailgating, carpooling, and environmental issues specific to that region. Moreover, *green games* are an effective way to influence the behavioral intentions of fans to engage in environmental behaviors at the game and in their everyday lives (Casper et al., 2014).

Green Building in Sport

Stadiums recognized for their pro-environmental designs typically demonstrate efficiency proficiency in several different categories, including site selection, water use, energy consumption and atmospheric emissions, materials and resources selection, and innovation in design and operations (Kellison, 2015). More specific examples of sustainable stadium initiatives include: constructing a new facility on a reclaimed brownfield (e.g., Nationals Park; Lambert, 2008); upgrading infrastructure designed to promote public transportation (e.g., London Olympic Stadium; International Olympic Committee, 2013b); capturing rainwater for field irrigation (e.g., Suncorp Stadium; Suncorp Stadium, 2010); installing wind turbines (e.g., Lincoln Financial Field; Bauers, 2013) or solar panels (e.g., Levi’s Stadium; Levi’s Stadium, 2013) on or around the stadium; developing an efficient waste management program (e.g., Ohio Stadium; The Ohio State University, 2012); and installing LED lights (e.g., Bell Centre; Belson, 2013). Additionally, the separate launches of the USGBC’s Leadership in Energy and Environmental Design (LEED) rating

system in 2008 and the Green Sports Alliance in 2011 reflect the relatively recent development of green building in sport (Kellison, 2015).

As further evidence that pro-environmental stadium design is becoming a more mainstream occurrence, consider the fact that several prominent architecture firms have made sustainability a central feature of their project portfolios. Populous, for example, has designed more major LEED-certified stadiums than any other company (Kellison, 2014). Two other large design firms, AECOM and HKS, were ranked third and ninth, respectively, in *Engineering News-Record's* "Top 100 Green Buildings Design Firms" for 2014. Additionally, HKS recently committed to the Architecture 2030 Challenge, an international program of architects and builders seeking to make all new constructions and major renovations carbon neutral in 2030 (Architecture 2030, 2011; HKS Architects, 2014).

The examples provided are only a selection of ways sport organizations have leveraged their efforts to increase environmental awareness among community members. Furthermore, although there is evidence that organizations are actively promoting their pro-environmental initiatives, it remains unclear whether they are doing so in response to the broader environmental movement or because they are attempting to pioneer a new culture of sustainability in sport. As discussed previously, for advocates seeking to increase the number of sustainably designed facilities in professional sport, understanding this distinction is necessary for developing the most persuasive defense of green building. In acknowledgement of this need, in the remaining sections of this paper, we examine the link between sustainable design in sport and social change.

METHOD

The purpose of this study was to investigate the link between pro-environmental sports stadiums and social change. More specifically, we sought to learn whether social change was driving green building in sport, or vice versa. Given this goal, it was necessary to gain the insights of persons actively involved in the early stages of stadium planning, as it is during this time that the decision to adopt sustainable design most often occurs. To meet this aim, over several months in 2012, we conducted standardized interviews with a convenience sample of 13 lead designers of pro-environmental sports facilities as part of a larger study on sustainability and sport. These designers or the stadiums for which they were responsible were deemed "pro-environmental" based on media recognition or formal facility certification (e.g., LEED designation). In sum, interviewees were directly involved in the design of over 25 green stadiums. These facilities are located across four continents, including North America, Europe, Australia, and Africa, and have been used to host a wide range of leagues (i.e., Major League Baseball; National Football League; college basketball and football) and large-scale events (i.e., FIFA World Cup; Olympic and Paralympic Games).

As noted by Horne (2011), architects are instrumental not only in designing the physical layout of a facility, but also in providing "meaningful discourses about the buildings and the cultural spaces they produce" (p. 220). The stadium designers interviewed in this study were directly involved in key conversations with team ownership and management, university stakeholders, building contractors, and other designers about the respective stadiums' designs. Thus, the stadium

planners' high levels of experience and expertise contributed to the credibility of the qualitative study (Milne & Oberle, 2005).

Prior to providing responses, participants received a list of questions to guide discussion about their stadiums' planning stages. In their responses, however, participants were encouraged to provide open and, when appropriate, unsolicited testimony, thereby lending to the study's authenticity (Milne & Oberle, 2005). Designers responded to 14 questions, samples of which included: "Is social change inspiring green building, is green building inspiring social change, or is neither happening?" and "How important are the team owners, facility managers, and/or civic leaders in the green building process?" Facility designers participated asynchronously via online software, which was considered appropriate given the limited availability of participants and the minimal environmental impact of the virtual format. The online instrument construction aligned with the recommendations of Dillman, Smyth, and Christian (2008), who provided suggestions to minimize nonresponse and measurement error.

The responses were copied and stored using NVivo 10 qualitative data analysis software (QSR International, 2012). A total of 3,375 words were analyzed and coded using the three-part sequence (i.e., open, axial, and selective) suggested by Strauss and Corbin (2008). First, in the open coding step, each line of empirical material was categorized into 89 "free nodes." Second, in the axial coding stage, 13 first-order themes were formed between the free nodes identified previously. Finally, a group of four higher order themes were deemed central to this article's research purpose (i.e., sustainable stadium design as a driver or consequence of social change). Finally, to provide support for the empirical material's trustworthiness and credibility, participants were debriefed, given the opportunity to review a transcript of the interview, and permitted to clarify a response when desired (Edwards & Skinner, 2009).

RESULTS AND DISCUSSION

As awareness of environmental impact has risen globally, widespread change has occurred across nation-states, industries, and individual behaviors. As one example, the environmental movement that emerged in the US during the late 20th century led to major transformations in public policy, manufacturing, and the economy (Carmichael, Jenkins, & Brulle, 2012). The sport industry has responded with its own share of eco-friendly products and services (Trendafilova, Babiak, & Heinze, 2013), but in some cases, organizations have been accused of "greenwashing," or aggrandizing their environmental commitments (Boykoff, 2012; Peattie & Crane, 2005). Of all the sustainability initiatives taking place across sport, however, green stadiums represent perhaps the most earnest symbols of environmental commitment (Kellison & Mondello, 2012). Given the time and resources (i.e., financial, human) required to plan, design, construct, and maintain environmentally sustainable sports facilities, they represent major transformative changes to both the organization and the industry (Mallen & Chard, 2012).

Sustainable Design as a Consequence of Social Change

To better understand the dynamic relationship between the environmental movement and pro-environmental stadium design, the architects interviewed for this study were asked to comment on what they saw as the driving force behind sustainable stadium construction. That social change was the principle influencer was a common refrain among interviewees. As the senior

architect of a Major League ballpark summarized, “Increasing social awareness of climate change and an appreciation for sustainability issues associated with our legacy to future generations is driving sustainable design.” Here, by referencing climate change, the interviewee channels a mainstay of the green movement; as noted by Jamison (2010), the issue of climate change arose in the 1970s and 1980s and remains a key tenet of environmental activism today. According to the designer, the rise in eco-friendly stadiums is the result of an increasingly aware public.

A number of stadium architects interviewed for this study provided examples of sustainable products and services that, in their view, emerged from shifting attitudes about the need to reduce waste and improve efficiency in all walks of life. Said the vice president of a stadium construction project, “I believe social change is inspiring ‘green’ in every aspect and buildings are just one of the results. Green cars, homes, travel, marketing...” As awareness of broad sustainable issues (e.g., climate change) has grown, so has the public’s knowledge of sustainable technology and design (USGBC, 2011). For instance, an architect responsible for the pro-environmental design of a collegiate football stadium argued that because of public pressure, teams were beginning to think beyond simple operating strategies to reduce their environmental impacts: “I feel that everyone’s increased awareness to the environment is impacting the need to conserve energy, not only in post occupancy but during construction as well—so social change is inspiring green building.” According to this respondent, the recent growth in sustainable stadium design was a response to increasingly sophisticated calls for change, where an in-house recycling program and public service announcements could no longer wholly satisfy consumers. While much of the literature presented in the review portrayed sport as a vehicle for social change, most experts interviewed in this study expressed the belief green building was a byproduct of a larger social movement, thereby suggesting that environmental initiatives in sport are most likely to occur when decision-makers perceive the general public and community groups to be especially mindful of sustainable issues.

Exceptions to the Rule? Early Adopters of Green Building

While the majority of respondents indicated that social change was driving sustainable stadium design, several still acknowledged the possibility that the trend of green building in sport would only continue because of the positive outcomes that came after construction. As the project designer of multiple sustainable facilities concluded, “Both [social change and green building] are happening. Social change first. Now it’s a trend. It would not continue if it didn’t add value.” The added value of a sustainable stadium is an important consideration, particularly from the perspective of ownership. A key member of a FIFA World Cup stadium project discussed this idea further:

I believe that social change is inspiring green building. Sports venues driven by ownership likely would not include these environmental features just for the sake of including them, as it doesn’t translate into more tickets sold or added revenues. Rather, the negative PR associated with not having these features makes it now table stakes.

According to this respondent, the momentum of the sustainability movement was so strong that teams electing not to adopt pro-environmental initiatives would be *negatively* impacted, a notion

supported in the literature (e.g., Babiak & Trendafilova, 2011; Walker, 2013). For example, Kassinis and Vafeas (2006) noted that community groups formed around an environmental cause “can influence resource flows toward an organization directly (in the marketplace) or, more importantly, indirectly, through the public policy process” (p. 147). Such influence can manifest in several forms, including boycotting games or events, petition gathering, or supporting pro-environmental legislation.

Even so, as discussed in the introduction, committing to constructing a sustainably designed stadium comes at a large price. Furthermore, as discussed in the literature review, given that green technology intended for large public assembly facilities is relatively new, early adoption of sustainable design carries a fair amount of risk. The principal architect of a green basketball arena explained why owners have not taken the decision to invest in sustainable design lightly: “I would say social change is the larger driver. However social change does not come about until someone takes the risky first step to test new technologies in their building programs.” The project manager of multiple sustainable stadium renovations and constructions expanded on this idea. As shown in the quote below, while social change may have driven initial efforts to build greener facilities, pioneering owners are also deserving of recognition:

What came first? The chicken or the egg? In my opinion, social change gave birth to green building concepts. These concepts have been refined, further defined, and quantified through trial and error. The concepts and process have continued to evolve. Now, green building is something tangible that it wasn't a decade ago and it is inspiring the design profession (and others such as developers, contractors and owners) in a way it couldn't previously. The movement has defined how professionals can and should be accredited but more important, it is influencing the economics of the construction industry.

As both of the above designers discussed, the influence of social change on green building is unmistakable. For instance, in a study of industrial plants in the US, Kassinis and Vafeas (2006) observed that as membership numbers in a local environmental group increased, the level of toxic emissions in plants decreased. Still, to argue that pressure from the environmental movement was so strong that it left owners with no other choice is to discredit early adopters of sustainable design, who committed to environmental stewardship despite the premium cost, unproven technology, and little attention across the industry (Mallen, Adams, Stevens, & Thompson, 2010).

Architects and the Limits to Environmental Stewardship

When asked to consider whether social change was occurring as a result of green stadium construction, the sustainability coordinator of two LEED-certified ballparks recognized that such change could be occurring; nevertheless, fostering social change was not the priority of his firm:

As a global leader in civic architectural projects, we've seen firsthand how incorporating sustainable design strategies has led to the education of the many hundreds of thousands of visitors that attend events at our facilities each year. We don't, however, profess to inspire social change through green building, but rather

provide each client with the high-performance facility that they seek to provide for their community.

In his view, social change could only occur if an organization continued to promote a pro-environmental agenda after its stadium opened. Indeed, previous research has shown that as sport consumers are exposed to a team's pro-environmental practices, they are more likely to adopt pro-environmental behaviors in their own lives (Inoue & Kent, 2012a). As a chief architect of several college facilities lamented, it appears that some teams are falling short when it comes to inspiring change among consumers:

My initial thought is that green building is inspiring social change although I'm surprised habits have not fully changed yet. I see green buildings overnight with a significant amount of lights left on. People will not walk an extra five feet to recycle their bottle. But it's nice to say you have a recycling program!

Though discouraging to environmental advocates, the above testimony is not entirely unexpected. Given the relative newness of sustainable technology in stadium design, few sport organizations are equipped with staffs that have the proper training to operate facilities to optimal efficiency (Trendafilova, Kellison, & Spearman, 2014) and properly market their green initiatives (Kellison & Kim, 2014).

The above testimony indicates that, as individuals, facility designers have limited opportunities to increase the environmental performance of their clients. During early planning, architects may emphasize the value of green building, but facility designs are ultimately at the mercy of owners and other decision-makers. Even when owners embrace pro-environmental initiatives, the facility designer's influence is mostly limited to the conception and construction phases of a stadium project. That is, despite a stadium being designed to include cutting-edge technological innovations aimed at maximizing energy efficiency and limiting resource consumption, such advances are mitigated if the facility is improperly managed and maintained once it opens. Instead, facility designers have decidedly greater influence as a collective, as illustrated previously with the number of architecture firms publicizing their support for sustainable facilities (e.g., Populous, AECOM, HKS).

The Movement Forward: The Future of Sustainable Stadium Design

Finally, some facility designers viewed the relationship between social change and sustainable design as cyclical—that to some extent, social change is both driving and being driven by green building. This cyclical nature is particularly apparent within the stadium architecture industry, a point driven home by the project designer of several indoor and outdoor sporting venues:

The idea of green building has sparked many conversations in our industry. Designers and architects are starting to think more down the lines of sustainability and delivering these projects with a green design allows clients and user groups the ability to talk about their projects giving back to the environment. On the other hand, by producing these projects with sustainable ideas, people are starting to grab a hold of new trends and discuss the possibility of future endeavors.

This comment illustrates the steadily increasing momentum of the green movement in sports stadium architecture discussed in the literature review. As the movement started creeping into the industry, architects began thinking about how to minimize the environmental impacts of their designs. As the number of green stadiums has grown in the past decade, accompanying innovations in technology have allowed engineers and designers to reach new heights of environmental stewardship, particularly in the area of energy efficiency. Despite the slow growth of sustainable design in sport, the architects interviewed for this study expressed confidence that green stadiums—today viewed as unique and the product of forward thinking organizations and designers—would eventually be considered typical.

The argument that the environmental movement predates the pro-environmental sports stadium can be made with little dispute. Until recently, sustainable technology was inadequate for handling the huge demands placed by large sports facilities. Intuitively, the sheer size and concentration of spectators work against environmental design principles, but facility designers and engineers are increasingly improving their capability to handle these challenges. As evidence of this emerging technology, the “green pledges” of multiple design companies discussed previously also suggest that pro-environmental design remains appealing to sports organizations and that the number of sustainable stadiums should grow in the future.

The optimism of stadium designers notwithstanding, growth in pro-environmental stadium constructions has been sluggish. As discussed in the introduction, green-certified designs have accounted for less than 40% of all North American professional stadium constructions since 2006. Thus, the fact remains that despite the momentum of the environmental movement (both generally and in sport), the majority of sports team owners are unconvinced that pro-environmental stadium design has become an accepted standard among fans, the general public, and their peers. Most designers interviewed in this study pointed to the influence of social change to explain the decision to adopt sustainable stadium designs; therefore, it is likely non-adopters were either unaware of or skeptical toward the progress of the environmental movement.

Environmental advocates may find the slow rate of progress in sport discouraging. The results of this study indicate that sports organizations competing in green stadiums engage in educational initiatives designed to elicit social change among their spectators, reinforcing previous research that has highlighted pro-environmental teams’ social marketing techniques (Inoue & Kent, 2012a; Kellison & Kim, 2014). Based on this finding, activists must continue to find ways to demonstrate to decision-makers that in addition to its environmental and social benefits, green building can be an astute economic decision. Additionally, a majority of interviewees indicated that social change has begun pushing owners to consider their roles in reducing the environmental impacts of their teams. As ordinary citizens, consumers, and policymakers are becoming increasingly aware of the need to be ecologically mindful, early adopters of sustainable design in sport are enjoying recognition as industry pioneers while avoiding the negative public relations that is beginning to accompany decisions not to adhere to pro-environmental principles (e.g., Markiewicz, 2013; Solomons & Willacy, 2014). Public pressure undoubtedly plays a role in the choice of sustainable design adoption. As discussed further in the concluding section, future

research should continue to untangle the effectiveness of environmentalists' motivational tactics and the perceived barriers of team ownership for green building.

CONCLUDING REMARKS

The primary goal of this research was to provide a qualitative understanding of how social change has influenced green building in sport, and vice versa. In previous research, sport has been shown to foster significant social change with respect to education, health, international relations, and the natural environment. This study was little exception, as interviewees indicated that the first wave of pro-environmental stadiums in professional sport would eventually lead to increasingly green designs in the future. A second finding of this study was that the core of existing sustainable stadiums in sport was the product of broader social change occurring around the world. This finding, typically unreported in the literature, is relevant to environmental advocates seeking to increase the number of green stadiums in sport. Architects also indicated that, as individual designers, their influence was limited. Instead, they argued social pressure coming from fans, environmental activists, and ordinary citizens weighed heavily on decision-makers. Demonstrating the benefits of a team's alignment with the environmental movement would encourage further adoption of sustainable design in sport. The most effective methods for making such a connection, however, are currently unknown.

In this study, the sample represented facilities in which environmental sustainability had been successfully implemented. To gain further understanding of why decision-makers are moved to adopt pro-environmental sustainable designs, future research should explore decision-making surrounding new stadiums that have not met environmental standards. Identifying what particular factors (if any) were considered before rejecting a sustainable stadium initiative would grow our knowledge about why the influence of social change on green building varies so greatly. Additional research should also investigate how decisions related to sustainable design adoption are actually made. Determining how costs and benefits are analyzed, what cost premiums owners are willing to accept, and the primary sources of support and opposition toward green stadium building would shape our understanding of sustainable stadium design adoption. Interviews with policymakers and team personnel could shed additional light on how decisions related to pro-environmental initiatives are made.

We endeavored to build upon the existing literature on sport, social change, and the natural environment by exploring the link between the environmental movement and the decision to incorporate sustainable design in new or renovated arenas, ballparks, and stadiums. The architects interviewed in this study varied in their perspectives on the relationship between social change and sustainable stadium design. The majority of interviewees expressed the belief that early adopters of sustainable stadium designs were influenced by the rising tide of social interest in environmental stewardship. Additionally, several architects interviewed in this study contended that the acclaim directed toward the earliest pro-environmental sports facilities would drive social change both in sport and among fans. The testimony provided by architects suggests that owners differ widely in their reasons to integrate (or not integrate) environmentally sustainable technology in their facilities' designs. Advocates seeking to grow the rate of eco-friendly facility adoption in sport, then, must be both adaptive (depending on the individual view

of decision-makers) and comprehensive (showing social change as both a driver and outcome of sustainable design) in future approaches.

REFERENCES

- Architecture 2030. (2011). The 2030 challenge. Retrieved from <http://architecture2030.org>
- Aspen Institute. (2014). About Project Play. Retrieved from <http://aspensprojectplay.org>
- Babiak, K., & Trendafilova, S. (2010). CSR and environmental responsibility: Motives and pressures to adopt green management practices. *Corporate Social Responsibility and Environmental Management*, 18, 11–24.
- Baker, W. J. (1988). *Sport in the Western world* (revised ed.). Urbana: University of Illinois Press.
- Bauers, S. (2013, April 16). Philadelphia Eagles green: Lincoln Financial Field generating energy with solar panels, turbines. *Philadelphia Inquirer*. Retrieved from <http://articles.philly.com>
- Belson, K. (2013, October 8). Sports beginning to see the energy efficient light. *The New York Times*. Retrieved from <http://www.nytimes.com>
- Beyond Sport. (2014). Events: Beyond Sport United 2014. Retrieved from <http://www.beyondsport.org>
- Bloomfield, G. L. (2003). *Duty, honor, victory: America's athletes in World War II*. Guilford, CT: Lyons Press.
- Boykoff, J. (2012, April 22). Has London 2012 been greenwashed? *The Guardian*. Retrieved from <http://www.theguardian.com>
- Carmichael, J. T., Jenkins, J. C., & Brulle, R. J. (2012). Building environmentalism: The founding of environmental movement organizations in the United States, 1990–2000. *The Sociological Quarterly*, 53, 422–453.
- Casper, J. M., Pfahl, M. E., & McCullough, B. (2014). Intercollegiate sport and the environment: Examining fan engagement based on athletics department sustainability efforts. *Journal of Issues in Intercollegiate Athletics*, 7, 65–91.
- Ciletti, D., Lanasa, J., Ramos, D., Luchs, R., & Lou, J. (2010). Sustainability communication in North American professional sports leagues: Insights From web-site self-presentations. *International Journal of Sport Communication*, 3, 64–91.
- Danish, S. J., & Nellen, V. C. (1997). New roles for sport psychologists: Teaching life skills through sport to at-risk youth. *Quest*, 49, 100–113.

- Davies, J., Foxall, G. R., & Pallister, J. (2002). Beyond the intention-behaviour mythology: An integrated model of recycling. *Marketing Theory*, 2, 29–113.
- Edwards, A., & Skinner, J. (2009). *Qualitative research in sport management*. Burlington, MA: Butterworth-Heinemann.
- FIFA. (2014a). Football for hope. Retrieved from <http://www.fifa.com>
- FIFA. (2014b). Study on non-governmental organisations that use football as a tool for social development in Brazil. Retrieved from <http://www.fifa.com>
- García, C. (2012). The use of sports as a tool of public diplomacy in “stateless nations”: The case of the Basque Country in contemporary Spain. *Journal of Sports Media*, 7, 115-128.
- Gasser, P., & Levinsen, A. (2004). Breaking post-war ice: Open fun football schools in Bosnia and Herzegovina. *Sport in Society*, 7, 457–472.
- Goldberg, J. (2000). Sporting diplomacy: Boosting the size of the diplomatic corps. *The Washington Quarterly*, 23(4), 63–70.
- Hayhurst, L. M. C. (2009). The power to shape policy: Charting sport for development and peace policy discourses. *International Journal of Sport Policy and Politics*, 1, 203–227.
- HKS Architects. (2014). Sustainability. Retrieved from <http://www.hksinc.com>
- Holt, N. L., Tink, L. N., Mandigo, J. L., & Fox, K. R. (2008). Do youth learn life skills through their involvement in high school sport?: A case study. *Canadian Journal of Education*, 31, 281-304.
- Horne, J. (2011). Architects, stadia and sport spectacles: Notes on the role of architects in the building of sport stadia and making of world-class cities. *International Review for the Sociology of Sport*, 46, 205–227.
- Inoue, Y., & Kent, A. (2012a). Sport teams as promoters of pro-environmental behavior: An empirical study. *Journal of Sport Management*, 26, 417–432.
- Inoue, Y., & Kent, A. (2012b). Investigating the role of corporate credibility in corporate social marketing: A case study of environmental initiatives by professional sport organizations. *Sport Management Review*, 15, 330–344.
- International Olympic Committee. (2012). Ground of achievements: Final report, 2009–2012 quadrennial plan. Retrieved from <http://www.olympic.org>
- International Olympic Committee. (2013a). A direct line! 2013–2016 quadrennial plan. Retrieved from <http://www.olympic.org>

- International Olympic Committee. (2013b). London's 2012 sustainability legacy lives on. Retrieved from <http://www.olympic.org>
- International Olympic Committee. (2014). Olympic Games legacy: Lillehammer 1994 set the stage for sustainable Games legacies. Retrieved from <http://www.olympic.org>
- Ioakimidis, M. (2007). Green sport: A game everyone wins. *The Sport Journal*, 10(2).
- Jamison, A. (2010). Climate change knowledge and social movement theory. *Wiley Interdisciplinary Reviews: Climate Change*, 1, 811–823.
- Kassinis, G., & Vafeas, N. (2006). Stakeholder pressures and environmental performance. *Academy of Management Journal*, 49, 145–159.
- Kaufman, P., & Wolff, E. A. (2010). Playing and protesting: Sport as a vehicle for social change. *Journal of Sport and Social Issues*, 34, 154–175.
- Kellison, T. B. (2014). Greentrack: Major LEED-certified sport facilities, since LEED inception. Retrieved from http://plaza.ufl.edu/tkellison/_/Greentrack.html
- Kellison, T. B. (2015). Building sport's green houses: Issues in sustainable facility management. In J. Casper & M. E. Pfahl (Eds.), *Sport management and the natural environment: Theory and practice*. Taylor & Francis: London.
- Kellison, T. B., & Hong, S. (2015). The adoption and diffusion of pro-environmental stadium design. *European Sport Management Quarterly*, 15, 249–269.
- Kellison, T. B., & Kim, Y. K. (2014). Marketing pro-environmental venues in professional sport: Planting seeds of change among existing and prospective consumers. *Journal of Sport Management*, 28, 34–48.
- Kellison, T. B., & Mondello, M. J. (2012). Organisational perception management in sport: The use of corporate pro-environmental behaviour for desired facility referenda outcomes. *Sport Management Review*, 15, 500–512.
- Kicking AIDS Out. (2014). Retrieved from <http://www.kickingaidsout.net>
- Lambert, L. (2008, March 29). DC turns brownfield into "green" ballpark. *Boston Globe*. Retrieved from <http://www.boston.com>
- Levermore, R. (2008). Sport: A new engine for development? *Progress in Development Studies*, 8, 183–190.

- Levi's Stadium. (2013). NRG Energy installs 49th solar frame to complete Levi Stadium suite tower roof. Retrieved from <http://levisstadium.com>
- Long, J. G. (2013). *Public/private partnerships for major league sports facilities*. New York: Routledge.
- Mallen, C., Adams, L., Stevens, J., & Thompson, L. (2010). Environmental sustainability in sport facility management: A Delphi study. *European Sport Management Quarterly*, 10, 367–389.
- Mallen, C., & Chard, C. (2012). "What could be" in Canadian sport facility environmental sustainability. *Sport Management Review*, 15, 230–243.
- Manchester United Foundation. (2014). United for UNICEF. Retrieved from <http://www.mufoundation.org>
- Markiewicz, D. (2013, November 24). Cobb coalition: Delay Braves stadium vote. *The Atlanta Journal-Constitution*. Retrieved from <http://www.ajc.com>
- McCullough, B. P. (2013). Identifying the influences on sport spectator recycling behaviours using the theory of planned behaviour. *International Journal of Sport Management and Marketing*, 14, 146–168.
- McCullough, B. P., & Cunningham, G. B. (2010). A conceptual model to understand the impetus to engage in and the expected organizational outcomes of green initiatives. *Quest*, 62, 348–363.
- McCullough, B. P., & Cunningham, G. B. (2011). Recycling intentions among youth baseball spectators. *International Journal of Sport Management and Marketing*, 10, 104–120.
- Merkel, U. (2008). The politics of sport diplomacy and reunification in divided Korea: One nation, two countries and three flags. *International Review for the Sociology of Sport*, 43, 289–311.
- Milne, J., & Oberle, K. (2005). Enhancing rigor in qualitative description. *Journal of Wound, Ostomy and Continence Nursing*, 32, 413–420.
- National Parks Conservation Association. (2013). National parks and hydraulic fracturing: Balancing energy needs, nature, and America's national heritage. Retrieved from <http://www.npca.org>
- National Sports Law Institute. (2013). *Sports facility reports* (vol. 14). Retrieved from <http://law.marquette.edu>

- Natural Resources Defense Council. (2013, August). Game changer: How the sports industry is saving the environment. Retrieved from <http://www.nrdc.org>
- Ndlovu, S. M. (2010). Sports as cultural diplomacy: The 2010 FIFA World Cup in South Africa's foreign policy. *Soccer and Society*, 11, 144–153.
- Nelson, T. F., Stovitz, S. D., Thomas, M., LaVoi, N. M., Bauer, K. W., & Neumark-Sztainer, D. (2011). Do youth sports prevent pediatric obesity? A systematic review and commentary. *Current Sports Medicine Reports*, 10, 360–370.
- Nyikos, D. M., Thal, A. E., Hicks, M. J., & Leach, S. E. (2012). To LEED or not to LEED: Analysis of cost premiums associated with sustainable facility design. *Engineering Management Journal*, 24, 50–62.
- Obama, B. H. (2009, October 2). President Obama's address to the International Olympic Committee. *The New York Times*. Retrieved from <http://www.nytimes.com>
- Peattie, K., & Crane, A. (2005). Green marketing: Legend, myth, farce or prophecy? *Qualitative Market Research: An International Journal*, 8, 357–370.
- Peppard, V., & Riordan, J. (1993). *Playing politics: Soviet sports diplomacy to 1992*. Greenwich, CT: Westport Press.
- Pfahl, M. (2010). Strategic issues associated with the development of internal sustainability teams in sport organizations: A framework for action and sustainable environmental performance. *International Journal of Sport Management, Recreation, and Tourism*, 6(C), 37–61.
- Right to Play. (2014). Retrieved from <http://www.righttoplay.com>
- Schmidt, C.W. (2006). Putting the Earth in play. *Environmental Health Perspectives*, 114, 286–294.
- Solomons, M., & Willacy, M. (2014, June 6). Ipswich Council ignored environmental concerns to rubber-stamp stadium earmarked as new Brisbane Lions home. *ABC News*. Retrieved from <http://www.abc.net.au>
- Strauss, A. C., & Corbin, J. M. (2008). *Basics of qualifying research: Techniques and procedures for developing ground theory* (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.
- Sugden, J. (2006). Teaching and playing sport for conflict resolution and co-existence in Israel. *International Review for the Sociology of Sport*, 41, 221–240.
- Suncorp Stadium. (2010). Environment. Retrieved from <http://www.suncorpstadium.com.au>

- The Ohio State University. (2012). *Zero waste at Ohio Stadium: Achieving zero in 2012*. Retrieved from <http://footprint.osu.edu>
- The Ohio State University. (2013, January 13). Ohio State earns 2012 National Diversion Rate championship. Retrieved from <http://oeo.osu.edu>
- Trendafilova, S., Babiak, K., & Heinze, K. (2013). Corporate social responsibility and environmental sustainability: Why professional sport is greening the playing field. *Sport Management Review*, 16, 298–313.
- Trendafilova, S., Bemiller, J., & Hardin, R. (2012). The third pillar of Olympism: Past, present, and future. *Global Sport Management News*, 3, 2–4.
- Trendafilova, S., & Kellison, T. B., & Spearman, L. (2014). Environmental sustainability in sport facilities in East Tennessee. *Journal of Facility Planning*, 2, 1–10.
- United Nations. (2000). Press release DSG/SM/88. Retrieved from <http://www.un.org>
- United Nations. (2014). Sport for development and peace. Retrieved from <http://www.un.org>
- University of Florida Sport Policy and Research Collaborative. (2013). Research brief: What does the science say about athletic development in children? Retrieved from <http://sparc.hhp.ufl.edu>
- U.S. Green Building Council. (2011a). About USGBC. Retrieved from <http://www.usgbc.org>
- U.S. Green Building Council. (2011b). *Green building and LED core concepts* (2nd ed.). Washington, DC: U.S. Green Building Council.
- Walker, M. (2013). Does green management matter for donation intentions?: The influence of environmental consciousness and environmental importance. *Management Decision*, 51, 1716–1732.
- Welty Peachey, J., Cohen, A., Borland, J., & Lyras, A. (2011). Building social capital: Examining the impact of Street Soccer USA on its volunteers. *International Review for the Sociology of Sport*, 48, 20–37.
- Welty Peachey, J., Cunningham, G. B., Lyras, A., Cohen, A., & Bruening, J. (2015). The influence of a sport-for-peace event on prejudice and change agent self-efficacy. *Journal of Sport Management*.
- World Commission of Environment and Development. (1987). *Our common future*. Oxford, UK: Oxford University Press.

World Health Organization, (2003). *Health and development through physical activity and sport*.
Geneva, Switzerland: World Health Organization.

Zirin, D. (2009). *People's history of sports in the United States: 250 years of politics, protest,
people, and play*. New York: The New Press.

AUTHOR CONTACT DETAILS

Timothy B. Kellison
University of Florida
tkellison@ufl.edu

Sylvia Trendafilova
University of Tennessee
sylviat@utk.edu

Brian P. McCullough
Seattle University
mccullb@seattleu.edu

JOURNAL CONTACT DETAILS

Special Edition Editors
Popi Sotiriadou
Griffith University, Australia
p.sotiriadou@griffith.edu.au

Brad Hill
Griffith University, Australia
brad.hill@griffith.edu.au

Executive Editor
Charles Arcodia
c.arcodia@griffith.edu.au

IJEMR Website
www.ijemr.org

The *International Journal of Event Management Research*
is a double-blind, peer reviewed journal.

ISSN 1838-0681