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The present study analyzes American college football stadia of the current Division I Football Bowl Subdivision (FBS) membership from the National Collegiate Athletic Association (NCAA) from 1869 through 2019 using the concept of innovation diffusion. Within, we created a five-stage ideal-type to highlight key innovations, environmental cues, social systems, and communication channels that caused and/or explain the eventual development of the stadiums. To complete this work, we utilized the historical method and incorporated various types of renovation (i.e., restoration, reconstruction, rehabilitation, and preservation) into the analysis. From 1869 thru 2019, we found evidence of over 1,800 playing grounds/construction projects. Furthermore, we discovered institutions of higher education played in 137 pre-existing venues, built 285 new facilities, and engaged in roughly 1,400 renovations of those venues. Regarding renovation, rehabilitation represents the most prolific building activity followed by reconstruction, preservation, and restoration. Finally, we offer information about what the past trends in facility construction tell us about the prospective future.

Keywords: Innovation diffusion, ideal-type, history, football, stadium

The notion of a stadium-building "arms race" has generated significant discussion over several decades with respect to institutions of higher education (e.g., Cohane, 1951; Edwards, 1984; Lewis, 1965; Kahn, 2007; Tsitsos & Nixon, 2012; Weyand, 1955; Young, 1886). For instance, schools engaged in stadium construction or renovation activity since the late 19th century to produce more revenue, develop better quality venues for core participants, and capture significant attention from alumni, fans, and the media with which they are constantly trying to build and maintain relationships (Gaul, 2015; Oriard, 2001; Tsitsos & Nixon, 2012).

Regarding actual construction, commercial sponsorship and television deals prompted significant structural changes (e.g., production space, signage, and camera locations) on sport stadia because they provide significant financial resources to conferences and their member universities (Gaul, 2015). Donors, offering substantial support to athletic departments with large amounts of financial capital (Gaul, 2015; Kahn, 2007; Tsitsos & Nixon, 2012), also compelled the creation of special seating options (e.g., luxury suites and club seating) and amenities for them to enjoy (Mayer, Morse, & DeShriver, 2017; Titlebaum, DeMange, & Davis, 2012). Increasing enrollments, population changes, and growing interest in football also encouraged the development of new seating, restrooms, and concession stands among other items focused on satiating consumer needs (Pfleegor & Seifried, 2015; Seifried, 2016; Seifried & Kellison, 2019; Seifried & Novicevic, 2015; Seifried & Tutka, 2016).

Although not previously articulated, an underlying explanation of the stadium arms race involves innovation diffusion. Rogers (2003) defined innovation diffusion 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" (p. 20). The growth and spread of modern sport stadia should be "conceptualized as a form of innovation diffusion" because, like sport, stadia development occurred through a somewhat predictable "series of events" greatly influenced by technology, geographic location, and environmental conditions (Bale, 1984, p.38). Interestingly, Bale (1984) and Hong (2012) noted traditional diffusion research in sport is generally limited to anthropological or cultural-centered diffusion but none to date used innovation diffusion as a lens to understand stadia development as a cultural product. We value, as Hardy, Loy, and Booth (2009) suggest, that stadia can be cultural products due to their ability to convey the values and identity of a specific community and era at a particular point in time.

The present study analyzes American college football stadia of the current Division I Football Bowl Subdivision (FBS) membership from the National Collegiate Athletic Association (NCAA) during the late 19th century through 2019 using the concept of innovation diffusion to identify the somewhat predictable, non-random "series of events" and innovations incorporated into facilities over time. Notably, we believe the current research honors the call by Damanpour and Schneider (2006) who argued for more intense study of "innovation characteristics" that help individuals or institutions achieve and/or fulfill their goals and/or mission (p. 497). Within this study, the historical method is used and an ideal-type narrative is employed as a heuristic device to frame various stages of college football stadium construction to help anticipate future changes.

With respect the choice of a historical research approach, sport management scholars previously (e.g., de Wilde and Seifried, 2018; de Wilde *et al.*, 2010; Seifried, 2010, 2017) advocated for the expansion of the field's research approaches through the context-focused methods. Of note, we assume an applied history approach because it promotes "knowledge or

theory building" within "research of events, establishment of patterns, and attempts to understand past settings/conditions to help practitioners and scholars of the present understand more efficient ways to avoid failure and frustration with their practical and conceptual work" (Seifried, Katz, & Tutka, 2017, p. 380). Brophy (2013) further advocated for the use of applied history because trend assessments emanating from applied history can help practitioners ignore or justify specific course of actions. Overall, we create an inventory of facility information on stadia, which we believe will be useful to sport management practitioners and scholars to present not only where facility design has been but also where facility construction is going.

The current research also highlights key innovations and environmental cues that caused the eventual development of the stadiums to help schools meet their academic, social, and financial goals. Within, we incorporate the concept of renovation broadly while also uniquely applying Weeks and Grimmer's (1995) various types of renovation (i.e., restoration, reconstruction, rehabilitation, and preservation) to the analysis. Such a point is compelling because many college and university stadia have long legacies and may have avoided razing in favor of renovation activities due to the heritage built over time in those venues via innovations. Lastly, we feel compelled to point out the context of the NCAA Division I FBS is attractive because of the well-documented history and data available on their venues. Moreover, a variety of scholars (e.g., Oriard, 2001; Smith, 2001; Watterson, 2002) advocated that learning the data trends of the NCAA Division I FBS context can help support interests of athletic departments to make responsible decisions regarding debates to build new or renovate.

Theoretical Framework

The current project views innovation diffusion as a social experience which makes use of communication channels to create innovations or re-invent them to fit the specific needs of the organizations that make up the social system (Carey & Mason, 2014; Hong, 2012; Rogers, 2003). Studies on innovation diffusion (Bale, 1984; Hong, 2012; Rogers, 2003; Seifried et al., 2017) have traditionally examined the components of time, communication channels, social systems, and geography. Thus, following Yates (2014) recommendation for conducting historical research using theory, the following section explores those components and seeks to generate answers to various research questions, which we utilize within the creation of ideal-type stages.

Time

Time is used as a way to measure the speed and success of innovation diffusion (Compagni, Mele & Ravasi, 2015; Dearing, 2009; Rogers, 2003). Within this point, Rogers (2003) suggested the adoption of innovation may vary based on five considerations: 1) relative advantage, 2) compatibility, 3) complexity, 4) trialability, and 5) observability. Other works also highlight interests in measuring the difference between the time gaining knowledge about an innovation to the actual decision to adopt (Dearing, 2009; Dewett & Jones, 2001). Finally, Seifried et al. (2017) positioned the adoption and diffusion of innovations is mediated by the seriousness of environmental shocks. Environmental shocks create conditions that prompt the coalition of opinion leaders in an institutional field to search for solutions or capitalize on opportunities provided by the marketplace/environment (Seifried, et al. 2017). Presently, we ask:

RQ 1: What were specific stadia-related innovations and how is their adoption/diffusion timing related to various environmental cues*?*

Communication Channels

Communication is an obvious feature of innovation diffusion connected to time (Dearing, 2009; Seifried, et al., 2017). According to Rogers (2003), two main types of communication channels exist: 1) mass media and 2) interpersonal. Mass media communication includes platforms such as radio, television, newspapers, Internet, and social media platforms (Compagni, et al., 2015; Dearing, 2009; English, 2016; Rogers, 2003). Previously, mass media communication was conceptualized as a one-way process where senders transmitted information but did not receive back communication (Rogers, 2003). However, social media platforms and other forms of telecommunication created opportunities for interactive and simultaneous information exchange or feedback between sender and receiver (Dearing, 2009; English, 2016; Seifried et al., 2017); thus, changing the rate of diffusion and enhancing interpersonal communication in the process. Interpersonal communication allows the possible adopter to speak directly to the innovator in order to better understand how innovation should work or be implemented (Seifried et al., 2017). Examples of mass media-interpersonal communication include video conferencing, live streaming, and email. Ultimately, this collective information compels the present research to inquire:

RQ 2: What types of communication channels emerged overtime to facilitate diffusion and how was the timing of their invention connected to the adoption of innovations within stadia? Are more visual and instantaneous forms of mass communication channels associated with an increase in the rate of innovation diffusion*?*

Social System

Social systems involve organizations or individuals that are motivated by similar goals and may be driven by desires to cooperate (Dearing, 2009; Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou, 2004). Seifried et al. (2017) suggested interpersonal communication takes place amongst opinion leaders to discuss and ultimately select specific innovations (i.e., processes or products). Previous work also demonstrates interpersonal communication can be impacted by gatekeepers (e.g., organizations) who possess the ability to directly influence the success or rate of diffusion (Carey & Mason, 2014; English, 2016; Seifried et al., 2017). The star power of gatekeepers is also potentially impactful as they can potentially control external assessments on whether or not an innovation is attractive or less important. Saint and Roberts (2015) further speculated gatekeepers are recognized by their ability to control information and their access to networks capable of diffusing innovations. Assuming prestigious or highly-recognized institutions of higher education are also the equivalent to star gatekeepers, we ask:

RQ 3: Who were the various emerging opinion leaders and star gatekeepers and in what role did they generally serve regarding the introduction of stadia-related innovations?

Geography

Finally, multiple scholars (e.g., Bale, 1984; Johansson, 2011; Lanzolla & Suarez, 2011; Seifried et al., 2017) argued that innovation diffusion was largely based on physical geography (i.e., neighborhood effect). The neighborhood effect suggests similar organizations in the same geographic area are more likely to adopt the same innovation versus those organizations separated by large distances (Bale, 1984). For example, some research (e.g., Lanzolla & Suarez, 2012) discovered that organizations within close proximity are likely to use similar technology and are likely to transfer knowledge due to neighborhood effects. Still, geography is not just conceptualized anymore as physical space; it may also include virtual space via rising prominence of communication technology and acceptance of extensibility (i.e.., "the use of transportation and communication technology to help individuals and/or institutions imbue their thoughts or actions (i.e., presence) to others outside their immediate location") (Seifried, 2011, p. 515). Advancements in film, mobile technology, and television (e.g., high-definition television) are particularly relevant to extensibility and subsequent diffusion, prompting us to ask:

RQ 4: Were institutions likely to adopt similar stadia-related innovations to those in their physical geographic area and did advancements in telecommunication technology reduce the impact of physical geography on innovation diffusion?

Method

The historical method is one interdisciplinary research approach used to develop or capable of using theory to study organizations (Rowlinson, Hassard, & Decker, 2014; Seifried et al., 2017; Walker, Seifried, & Soebbing, 2018; Yates, 2014). To realize this ambition, the subsequent information outlines the pursuit of objectivism through various steps as previously offered by Seifried (2010, 2017), Seifried et al. (2017), and Walker et al. (2018).

The first step of the present historical inquiry required the collection of both primary and secondary documents on intercollegiate football stadia and playing surfaces from the first game in 1869 through the end of 2019. Primary sources included multiple types of items from a variety of locations. For instance, participation in archival work at both universities (n=40) and at the NCAA headquarters provided information through presidential papers, architectural plans, financing documents, student and local newspapers, game programs, organizational reports/memorandums, letters of correspondence, and official media guides. Secondary sources included history books, journal articles, and a variety of local and national newspapers. We also used several popular databases like HathiTrust Digital, Nexis-Uni, Google Scholar, SportDiscus, and the Avery Index to Architectural Periodicals to inform our research.

Media sources were important to the development of the project. For instance, as a primary source, newspapers offered factual accounts of facilities while as a secondary source they provided interpretations of events and behaviors of key personnel; all of which could be corroborated to help address concerns for dissonant data (Seifried et al., 2018). Notably, Deephouse and Suchman (2008) argued for this assumption as they suggested the mass media could serve as a resource to identify the norms of an institutional field and practices of individual organizations as legitimate.

The second step in the current research approach aimed to test the reliability of the sources along with comparing different narratives and information on the same historical events

to avoid selection bias toward specific conclusions (Rowlinson et al., 2014; Seifried, 2017). Also known as the source criticism, this test includes checks for internal and external validity (Seifried, 2010, 2017). The present internal criticism involved examining documents for gaps in data and explanations based on the author's intended audience. Further, we assessed their reputation as an author, skill and experience producing research-based findings, and/or access to resources (Seifried, 2010, 2017). The external criticism attempted to authenticate documents as being complete and included verifying dates (Seifried, 2010). With respect to reliability, we attempted to secure documents as close as possible to the construction or renovation date. Further, we worked with archivists and sought out use of finding aids or document catalogs. For historical researchers, it is critical to acknowledge the use of special collections or archives because it serves as significant "paradigmatic [. . .] disciplinary marker" (King, 2012, p. 13).

The third step in the present historical research approach compelled us to analyze and interpret the evidence tied to new construction and renovation. The researchers began by classifying information prior to triangulation (Seifried, 2010, 2017). For instance, the present study was only interested in identifying major renovations. Thus, we followed the frame established by Energy Efficiency (2010) who positioned those projects as efforts to substantially upgrade a facility and/or alter its layout. Finally, our system included classifying various renovations under Weeks and Grimmer's (1995) framework. Preservation serves to sustain "the existing form, integrity, and materials of a historic property" (Weeks & Gimmer, 1995, p. 16). Rehabilitation involves attempts to improve a property through repair and alternations that features appreciation for consumer and participant preferences (Weeks & Gimmer, 1995). Reconstruction comprises efforts to replace and/or rebuild non-surviving structures for the purpose of replicating its purpose (Weeks & Gimmer, 1995). Restoration contains work meant to depict the "features, and character of a property at a particular period of time" (Weeks & Gimmer, 1995, p. 116).

To organize the emerging themes, the researchers also documented specific changes using a spreadsheet of stadium-related innovations. Sample information collected includes:

1. School Name
2. Conference
3. Stadia/Field Name
4. Location of Stadia
5. New or Renovation
6. Type of Renovation (i.e., Preservation, Restoration, Reconstruction, Rehabilitation, or Combination)
7. Dome/Outdoor
8. Cost
9. Capacity
10. Parking
11. Number of Luxury Suites and/or Club Seats
12. Press Box
13. Type of Score/Videoboards
14. Disabled Seats
15. Number of Restrooms/Fixtures
16. Number of Concession Stands/Points of Sale
17. Lights
18. Seating (e.g., bleacher, chair back, grandstand, and standing).

Triangulation stresses the inclusion of multiple sources and notably through our spreadsheet, we were able to organize the data into stages of development regarding innovation diffusion.

Ultimately, the collection of this data and various anecdotes led the researchers to organize the analysis through use of an ideal-type narrative because it connects well with diffusion. More specifically, an ideal-type was employed because it incorporates the use of stages to "reduce the interpretive gap…helps to create an image of how history happens through a calculated and thoughtful collection of human activity" (Tutka & Seifried, 2015, p. 21). Furthermore, ideal-types act similarly to theoretical models in that each stage is systematically constructed to organize shared but essential characteristics (Tutka & Seifried, 2015).

Results and Discussion

The results and discussion feature a five-stage ideal-type of innovation diffusion. The ideal-type incorporates the various components of innovation diffusion, while also secondarily identifying the emergence of specific innovations overtime. Our analysis involved 130 Division I FBS institutions. Information from eight Ivy League schools is also presented through Stage 3 as the Ivy League schools were influential on the development of football until their de-emphasis of sport following World War II (Watterson, 2002). From 1869 thru 2019, we found evidence of over 1,800 playing grounds/construction projects. Within, we discovered institutions of higher education played in 137 pre-existing venues, built 285 new facilities, and engaged in roughly 1,400 renovations of those venues. Regarding renovation, rehabilitation represents the most prolific building activity followed by reconstruction, preservation, and restoration (Table 1).

With respect to *RQ1*, the present study found the following list of 20 innovations that physically altered stadia at institutions of higher education. This list includes:

1. Rules of play
2. Open field to enclosure
3. Uncovered wooden bleachers and covered grandstand seating
4. Reinforced steel and concrete
5. Parking
6. Restrooms
7. Concessions
8. Press boxes and media production space
9. Scoreboards (i.e., manual, electric, digital, and high-definition)
10. Stadium lights
11. Radio
12. Locker rooms and training rooms
13. Administrative/coaching offices
14. Television
15. Turf (i.e., artificial fields)
16. President box, luxury suites, and club seating
17. Disabled seating
18. Advertising signage and naming rights
19. Various connected building (e.g., retail, dormitories, academic services)
20. Wireless/mobile technology

Table 1
Stages 1-5 Average New Construction Capacity and Cost and Renovations Types and Totals

	New Construction Capacity	New Construction Cost	Renovations	Preservation	Restoration	Reconstruction	Rehabilitation
Stage 1							
Northeast (n=15)	5,655	23,718	8	0	0	3	5
Midwest (n=22)	1,814	2,721	15	0	0	3	12
South (n=14)	606	3,430	6	0	0	0	6
West (n=12)	864	750	6	0	0	1	5
Stage 2							
Northeast (n=23)	22,618	539,227	16	0	0	3	15
Midwest (n=31)	25,893	453,439	47	1	0	4	43
South (n=35)	10,218	253,853	43	0	0	2	41
West (n=22)	17,695	234,616	31	1	0	1	29
Stage 3							
Northeast (n=4)	16,666	472,667	9	1	0	1	9
Midwest (n=6)	20,315	347,712	12	0	0	0	12
South (n=14)	14,300	172,453	39	3	0	2	36
West (n=6)	7,917	137,740	23	0	0	0	23
Stage 4							
Northeast (n=8)	35,638	12,310,475	30	3	0	1	29
Midwest (n=9)	31.676	13,055,556	118	9	0	13	110
South (n=25)	30,464	10,326,377	162	7	0	9	156
West (n=17)	27,307	4,189,035	92	7	0	11	84
Stage 5							
Northeast (n=7)	35,521	142,985,714	84	8	0	6	78
Midwest (n=1)	50,805	288,500,000	208	5	1	20	192
South (n=11)	31,535	80,982,818	293	30	3	23	273
West (n=3)	53,779	200,033,333	155	7	0	15	148

Next, the present research discovered these innovations were influenced by a variety of environmental influences. For instance, we found the following impacted the diffusion process:

1. Progress and expansion of railroads/trains and highways/automobiles
2. Expansion of newspaper coverage
3. Invention of photography, telephone, television, and Internet
4. Rules standardization
5. Formation of athletic associations and conferences
6. Recognition of sport as a source of revenue, vehicle to develop alumni relationships, and tool to attract student enrollment
7. Increase in local or regional population and economic growth
8. Weather and fires
9. World War I memorials
10. Radio and advertising
11. Growth in sport architecture/engineering firms and academic journals
12. Development of athletic fundraising foundations
13. Great Depression and corresponding Works Progress Administration or Public Works Administration funds
14. World War II
15. Serviceman Readjustment Act (i.e., G.I. Bill) of 1944
16. NCAA Television Committee and *NCAA v. Board of Regents of the University of Oklahoma* (1984)
17. American with Disabilities Act of 1990
18. Academic/campus services (e.g., tutoring)
19. Student-athlete recruiting
20. Increasing demand by fans for amenities.

Information regarding *RQ2* thru *RQ4* is presented within the ideal-type stage narratives below.

Stage 1: 1869-1903

The earliest versions of college football were primarily organized before the 1860s by students in the Northeast as part of spontaneously emerging class competitions (Ingrassia, 2012). Standardized rules did not exist and faculty or administrative oversight was not present so students were the first opinion leaders. The thought to build or play in enclosed facilities for what was described as semi-organized chaos was not a priority for student participants (Camp & Deland, 1896). Early college football was not a mature business activity or initially developed with commercial purposes in mind. Thus, early college football games were commonly played on nearby city grounds or open multi-purpose campus fields that frequently offered little to no seating, prompting some spectators to walk the field as the line of scrimmage changed (Camp & Deland, 1896; Oriard, 1995).

Gradually, college football became more popular on campuses prompting students and their schools to form on-campus athletic associations (e.g., Harvard 1860; Princeton 1871, and Yale 1872) in order to organize events against other schools and to capture revenues. These school athletic associations typically charged a small membership fee to help fund the costs of playing football (i.e., equipping the team and leasing venues) and for travel to games against opponents in places like New York City (e.g., Polo Grounds), Hoboken (NJ- St. George Cricket

Grounds), New Haven (CT- Hamilton Park) and Springfield (MA- Hampden Park), where enclosed professional sport facilities (e.g., baseball, cricket, horse racing) already existed (Lewis, 1965; Watterson, 2002; Weyand, 1955; Young 1887). These early enclosures were often owned by entrepreneurs and rented by participating teams, who believed interested spectators would make use of trains to travel to these sites (Lewis, 1965). Other attendees who brought their horse drawn carriages as a vehicle to sit and watch games were charged more (Smith, 1990).

Revenue earned from admission fees ultimately encouraged the development of enclosed temporary venues on campus (i.e., Stage 1). By hosting games on campus, schools avoided paying rental fees and could secure a greater portion of the gate receipts, the only source of revenue being produced at this time (Ingrassia, 2012). To gauge their performance and to prepare for opponents, standardized rules were developed by interest associations in the 1870s and beyond, permanently shifting the control of athletics to the institution and emerging opinion leaders like alumni and university officials. The Intercollegiate Football Association (ICFA) formed the first set of standardized rules in 1876 (Camp & Deland, 1896). Charter members of the ICFA included prestigious institutions such as Harvard, Yale, Princeton, and Columbia (i.e., star gatekeepers) who directly impacted the development of Stage 1 on-campus facilities. As an example, the ICFA established a standardized field as 330 ft. by 160 ft. (Camp & Deland, 1896).

The power and prestige of star gatekeepers compelled others to adopt the ICFA rules because many institutions wanted to associate with these institutions, enjoy the revenues generated from competing against those schools, and possibly create a schedule featuring them (Lewis, 1965). As further evidence, university presidents and leading members of alumni groups throughout the U.S. sent letters to athletic committee leaders at Yale, Harvard, and Princeton requesting former players come to their schools, teach the game, and set up their facilities (Camp & Deland, 1896; Ingrassia, 2012). As coaches left the Northeast, their diffusion provided important interpersonal communication opportunities for institutions to quickly learn about how the leading schools in the Northeast not only played football but how they organized their sporting grounds.

The emergence of 80,000 miles of railroad tracks linking cities to college campuses and other cities also facilitated the diffusion of football and knowledge about facilities by 1880 (Lucas & Smith, 1978). Newspapers further prompted interest in rivalries and the creation of seats and campus enclosures. As an example, by the turn of the century major newspapers supported several dedicated writers to cover football (Lewis, 1965; Oriard, 1995). Their stories were often informed by other communication technology such as the telegraph and film, which increased the spread of information across the country. Newspapers and magazines on occasion discussed the playing field in some detail. However, sketches of games regularly appearing in newspapers and major magazines were more common with respect to depicting playing grounds.

From a geographic perspective, conferences in the Midwest (Western Conference- i.e., Big Ten) and the South (e.g., Southern Intercollegiate Athletic Association) emerged by the 1890s as significant social systems (Ingrassia, 2012; Oriard, 2001). These conferences demonstrate further evidence of a neighborhood effect as members shared information via interpersonal communication about the rules of football and facility arrangements. For instance, following the creation of the Big Ten in 1895, seven member schools either constructed new venues or made renovations to existing venues in the next five years making them similar in size.

The development of on-campus facilities started with the construction of Jarvis Field (Harvard) in 1874. Shortly thereafter, the neighborhood effect occurred with Princeton building University Field in 1877 before Yale erected Yale Field in 1884. Penn similarly constructed the

University Athletic Grounds in 1885 and Franklin Field in 1895 as significant on campus structures. Likewise, Cornell created Percy Field in 1889, Dartmouth built the Alumni Oval in 1893, and Brown assembled Andrews Field in 1899. The neighborhood effect also surfaced in the Midwest including new fields at Northwestern (1892), Michigan (1893), and the University of Chicago (1893) among others in the region. Out West, California-Berkeley developed West Field in 1885, which was followed by six other schools in the region. Interestingly, facility development was delayed in the South, which this work attributes to infrastructure issues following the American Civil War and poor resources (Blanton, 2014; Lucas & Smith, 1978).

A notable number of expansions also occurred before the end of the 19th century to take advantage of the burgeoning interest in football. Harvard reconstructed Jarvis Field in 1883, which later prompted the reconstruction of Princeton's University Field in 1885 (Cohane, 1951; Presbrey & Moffatt, 1901). Yale Field was similarly reconstructed but also rehabbed (i.e., regraded playing surface) in 1890 before receiving new bleachers again in 1897. Princeton also continued to add new bleachers in 1890 just before Harvard built Soldiers Field in 1894. Elsewhere, expansions occurred at the original venues of Michigan (1896), Iowa (1899), and Purdue (1899) among others in the Midwest. These renovation efforts were reconstruction and expansions of previous wooden bleachers. No restrooms, concessions, or anything else we consider to be part of a modern stadium were present. Of note, the construction of large grandstands occurred to accommodate increasing enrollments and alumni who started donating money for not only the expansion projects underway but also other campus buildings. Fans and media raved about the excitement of play and larger facilities that produced gates of over $20,000 for the biggest games of the late 19th century (Watterson, 2002). Yet, the failures of small campus grandstands and bleacher sections to support larger crowds led officials from across the country to examine stronger and longer lasting construction materials.

Stage 2: 1904-1929

The diffusion of reinforced concrete and steel as an innovation revolutionized the college football spectacle and solidified permanent stadia as an important legitimacy marker for what it meant to be a modern university (Ingrassia, 2012). As an example, the development of on-campus permanent stadia (n=111) allowed universities to promote the university through their ability to host large capacities, which included increasing student enrollment numbers (Oriard, 1995; Watterson, 2002). Stadiums were also developed to be significantly larger than the surrounding population with the notable purpose of bringing alumni, future prospective students, and visitors to the university and city for football games (Ingrassia, 2012; Toma, 2003).

Harvard opened the first reinforced concrete and steel venue (i.e., Harvard Stadium) in November 1903 for $300,000. Through assistance of alumni, who provided approximately $100,000 in gifts to build the U-Shaped structure, Harvard was able to accommodate a large number of seats (i.e., 30,000) but also provide better and safer seating options (Blanton, 2014). One particular focus involved discouraging spectators from interrupting play on the field and improving egress and ingress along with horizontal and vertical circulation. Regarding these points, the design of Harvard Stadium included several entrance/exit and stairway spaces, offered wider concourses than its predecessor, and positioned the first row of seating nine-feet above the field. Further interests in reinforced steel and concrete centered on avoiding collapse and damage by fire, which plagued wooden venues. In Stage 1, the present study found at least 20 fires damaged sport venues in the 1890s (e.g., Michigan's Regents Field in 1895). Simultaneously,

others suffered collapse due to weather or natural deterioration (e.g., Pittsburgh's Recreation Park in 1897). This finding is significant as these events led to injury and exposed institutions to lawsuits.

The larger and safer reinforced steel and concrete venues notably captured more revenues from gate receipts than their predecessors not just because of their size and safety but thru other attractive amenities that served to increase comfort. For instance, although manual scoreboards emerged first, electronic scoreboards gradually surfaced as significant innovations through the information they provided. The current study discovered over 50 schools added one scoreboard with some adding a second scoreboard during renovations. Most of these scoreboards were basic, with just information about the score and time, but a few were more advanced. For instance, the Grid Graph scoreboard installed in the original construction of Tiger Stadium at Louisiana State (LSU) used illuminated light bulbs to provide spectators information about the type of play, players involved, and the position of the ball on the field (Seifried, 2016).

Notably, some universities also incorporated restrooms and concession stands into their new venues to improve spectator comfort. Examples include LSU and Stanford whom constructed a total of 16 and 19 restrooms when they opened in 1924 and 1921 respectively. Interestingly, permanent concession stands did not emerge until 1914 although portable stands were present in and outside stadia. The first stands appeared in the Midwest at Chicago's Wrigley Field and expectedly, Midwestern schools were the earliest adopters of concession stands (Tutka, 2016). As with restrooms, some venues remained ahead of others. For example, Pitt Stadium supported 14 concessions stands when it opened in 1925 and California Memorial Stadium possessed 13. In contrast, the Yale Bowl offered no restrooms when it opened in 1914. Overall, we found the importance of geographic proximity/conference association as significant in their diffusion.

The final major innovation impacting stadiums during Stage 2 involved the mass media. Over the previous decades more newspapers began to cover college football, which prompted the need for special reserved space for the press (i.e., press boxes). Overall, the present study found over 60 universities incorporated press spaces into their stadiums during Stage 2. In the 19th century, it should be noted that press spaces did exist but many were small simple open spaces (Oriard, 2001; Smith, 1990). Press boxes of the early 20th century were also small and simple but they became private enclosed spaces to provide more secluded working conditions for the press.

Following the erection of Harvard Stadium, the overall diffusion of reinforced steel and concrete occurred slowly at first and was impacted significantly by physical geography and available resources. Schools in the Northeast, with fewer funding resources, tended to build smaller stadiums that modeled directly either Harvard Stadium or the 71,000-seat Yale Bowl built in 1914. Syracuse University's Archbold Stadium (1907) was the first major reinforced steel and concrete facility to follow Harvard Stadium. Like Harvard Stadium, the 23,000-seat Archbold Stadium supported 30 entrance/exit tunnels and provided electricity inside the facility. Interestingly, to save money on construction costs, Syracuse selected a natural depression near a hillside they excavated to help build the facility. Yale also followed the Syracuse approach and used excavated material to create the 70,000-seat Yale Bowl. Moreover, Yale provided several acres of parking for 8,000 cars as the automobile industry grew after the assembly line transformed not only the number of cars produced in 1913 but lowered the costs to own an automobile (Ingrassia, 2012). Elsewhere, Princeton University similarly built Palmer Stadium in 1914 while Cornell University constructed Schoellkopf Field in 1915 with parking in mind.

Following the end of World War I in 1918, a stadium-building boom occurred outside the Northeast. More specifically, the present research found 58 new college stadiums constructed and 67 renovations between 1920 and 1929. First, in the Midwest and in some Western locations, the construction of stadia served as World War I memorials to substantiate their place as a significant campus building. Like their Northeastern peers, those stadia and subsequent renovations surfaced to be significantly larger than the surrounding community with the purpose of bringing alumni and future students to university for football games via the spectacle of play and showcase of campus spirit (Ingrassia, 2012; Toma, 2003). In the Midwest, Ohio State and Michigan notably followed the original designs of Harvard and Yale's U-Shape and bowl designs. On the West Coast, California and Stanford also built large venues, following the designs of Harvard and Yale; however, most other schools in less populated areas of the Midwest and West Coast regions built significantly smaller venues (i.e., under 20,000). In the South, new and emerging buildings were also typically small (i.e., 15,000). However, some football-playing schools in the South (e.g., Georgia, North Carolina, Alabama, and Vanderbilt) established their own large venues seating over 20,000 before 1930 as the popularity and quality of football in the South improved.

The diffusion of the aforementioned innovations occurred through interpersonal communication such as the developing social systems of conferences and the NCAA. Regional conferences were made up of schools in close geographic proximity to each other (Lewis, 1965). The success of the Big Ten and Southern Intercollegiate Athletic Association spawned interest in establishing additional conferences such as the Big 8 Conference (1907), Southwest Conference (1914), Pacific Coast Conference (1915), and Southern Conference (1921). All of these leagues included major football-playing schools that produced rivalries and subsequent pressure to adopt similar innovations through natural comparisons regarding their facilities.

In 1906, the Intercollegiate Athletic Association of the United States (IAAUS) formed with the purpose of overseeing intercollegiate athletics. Renamed the NCAA in 1910, the association helped develop a distinct social system that sought to facilitate competition and standardize playing grounds for likeminded and similarly resourced institutions. Within annual meetings, school opinion leaders drove diffusion and, in some instances, the conferences outlined the requirements for membership as including certain facility accommodations (Seifried, 2016). Such adoption patterns should not be a surprise as Greenhalgh et al. (2004) argued competition emanating from opinion leaders increases the rate of adoption. In the case of intercollegiate football, schools in direct competition with each other often built facilities within a short time period of each other as they did not want to fall behind their direct competition for students on and off the field (Ingrassia, 2012; Smith, 2008).

Finally, another type of the mass media, beyond newspapers, impacted the diffusion of stadium-related innovation for the first time. Specifically, we found sport-related journals, particularly for those interested in operations and facility development, provided critical information. From a facilities perspective, *The Athletic Journal* shared information about stadiums being developed around the country during the 1920s. For instance, in 1926, the journal offered information about Minnesota's Memorial Stadium (Steward, 1926), Cincinnati's Nippert Stadium (Chambers, 1926) and the Los Angeles' Memorial Coliseum (Farmer, 1926). Within, the articles provided specifics related to the size of the venue and the costs of construction.

Non-sport journals also offered information about the construction of college football venues, substantiating their prominence as a legitimacy marker and promotional tool for institutions. More specifically, the *Engineering News-Record* (e.g., "The Palmer Memorial,"

1914) and *American Architect* devoted space to the construction of several college football venues. As one example, Howard Dwight Smith's (1920) tour of stadia at Harvard, Princeton, and Yale discussed specific attributes of each along with their construction challenges. The present study also found Osborn Engineering designed and constructed several college structures during Stage 2 suggesting those structures likely shared many similarities, leading to enhanced diffusion. Osborn managed the construction of Michigan Stadium, the Minnesota's Memorial Stadium, Notre Dame Stadium and the Military Academy's (i.e., Army) Miche Stadium among many others after they started work on sport facilities in 1905.

Stage 3: 1930-1946

Stage 3 involved some new construction projects (n=30) but the number of renovations (n=83) established expansive rehabilitations as a new phase of stadia development. The key features of the rehabilitations primarily involved stadium expansion as gate receipts remained the main revenue source; however, the multiplication of amenities for players, spectators, and media personnel also impacted construction projects.

With respect to the players, locker rooms and training rooms were frequently renovated across this era to improve conditions for them. Regarding spectator amenities, the number of restrooms and concession stands continued to improve (Table 2). However, the incorporation of lights into stadia was an important innovation to not only provide a new type of spectacle (i.e., night football) but also because it served as a logical solution to combat early fall evenings and difficulties imposed by the Great Depression (e.g., competing against the search for work during daylight hours). Night games were rare before the Great Depression with only a few schools like Cincinnati and Syracuse hosting contests before the 1930s. However, the attendance success that schools enjoyed when incorporating lights encouraged other in their region to add those structures. As one example, in the South, LSU added lights to Tiger Stadium in 1931 based on the success Loyola University (New Orleans) experienced (Seifried, 2016). Out West, the present study found lights installed at places like Arizona, Arizona State, Oregon State, Washington, Brigham Young, and Hawaii among others during the 1930s for similar reasons.

For the media, press boxes were altered in several ways. First, they were expanded to accommodate newspapers who required more space for equipment (e.g., typewriters and telephones). Second, and more importantly, radio emerged as a significant innovation impacting stadia renovation. Radio was introduced to college football stadia in the 1910s and 1920s initially to broadcast special events like the annual Harvard-Yale game and the Rose Bowl (Oriard, 2001; "Radio to Broadcast," 1923; Smith, 2001). Within, telephone lines connected to the stadium allowed for the broadcasting of games beyond the local community (Barnouw, 1966; "Engineer Explains How," 1926). Radio was not a new invention as Guglielmo Marconi and others had been effectively using the technology since the turn of the century to communicate across large bodies of water for shipping purposes (Tutka, 2016). However, radio was underused before the 1930s despite the fact that nearly 130 universities held licenses to broadcast by 1925 (O'Toole, 2013). What changed was the number consumers who had access to radios (i.e., over 12 million homes by 1930; Oriard, 2001) and the number of stations that desired to profit from sponsorships sold for broadcasts (i.e., over 1,500 stations by 1930; Ruben, 2010). Natural breaks in the action within football contests provided attractive opportunities to radio stations and advertisers to work together to promote products and services (Oriard, 2001; Smith, 2001).

Table 2
Stages 1-5 Amenities and Other Characteristics

	Capacity	Parking	Luxury Suites	Club Seats	Disabled Seats	Restrooms	Concession Stands	Diffusion Notes
Stage 1	4,094	0	0	0	0	0	0	**Time:** Slow but gradual Northeast first to build followed by Midwest, South, and West. **Social System:** Students leaders initially later replaced by alumni and university officials **Communication:** Facilitated by newspapers and railroads **Geography:** Neighborhood effect prominent
Stage 2	22,572	1,840	0	0	0	3	2	**Time:** Slow initially but explosive during the 1920s, Northeast early leaders but Midwest and Western schools ascend, South trails **Social System:** Emergence of conferences and NCAA, alumni donors prominent, media, local businessmen/boosters **Communication:** Facilitated by newspapers, journals, railroads, and automobiles **Geography:** Neighborhood effect prominent
Stage 3	26,654	5,074	0	0	0	6	5	**Time:** Slow collectively due to challenges brought on by Depression and World War II. Substantial growth in the South **Social System:** NCAA, conferences, media, WPA/PWA **Communication:** Facilitated by newspapers, journals, automobiles but radio emerges as significant innovation **Geography:** Neighborhood effect prominent
Stage 4	50,648	7,311	5	108	58	21	17	**Time:** Substantially quicker diffusion of innovations **Social System:** NCAA, media, alumni and business leaders **Communication:** Television, emergence sport radio networks **Geography:** Erosion of neighborhood effect and emergence of virtual geography
Stage 5	51,371	8,230	50	1,801	477	29	23	**Time:** Rapid diffusion of innovation **Social System:** Conference and NCAA, media, alumni (i.e., large donors/suite holders), sponsors, broadcast partners **Communication:** Television, radio, Internet **Geography:** Virtual more prominent

Note. Above information is average of last facility played in each stage by each individual school

Universities saw the value of radio initially through the publicity broadcasts provided them. Thus, few schools initially sought out commercial advertisers for broadcast rights (O'Toole, 2013). However, the Great Depression prompted universities to seek out new revenue streams as gate receipts decreased. By the mid-1930s, schools and conferences successfully recruited and negotiated thousands of dollars in broadcast rights yearly (Oriard, 2001; Smith, 2001). While not the direct interest of the broadcaster, undoubtedly stories and information about stadiums was communicated including information about scoreboards, lights, and other stadium additions. To facilitate the broadcasting of games over the radio, space was provided for audio engineers and booth announcers ("Engineer Explains How," 1926; Oriard, 2001). From a stadium development standpoint, radio allowed the broadcaster to provide a verbal/virtual picture of the stadium, the crowd, and the game (Oriard, 2001; Smith, 2001).

Within all these changes, it should be noted that university leaders could easily pick up the telephone and call other schools to ask specific questions related to any stadium issue, as by the beginning of 1940 almost 30 million telephones were in use in the U.S. (Barnouw, 1966; Smith, 2001). The likelihood of their communication is strong as it appears the social system continued to advance. For instance, the membership of the NCAA grew significantly from the approximately 150 members in Stage 2 to well over 300 members by the end of Stage 3 (Crowley, 2006). Next, many universities continued to join conferences or establish new ones with like-minded and resourced peers. For instance, the Southeastern Conference (SEC) began football play in 1934. Charter members of the SEC, for example, were dissatisfied with the growth of the Southern Conference to a league over 20 schools. To prepare more attractive schedules with high-quality opponents, SEC schools created "exclusivity by emphasizing that the new conference hoped to develop public appreciation for the members… as both an educational and commercial enterprise" (Seifried & Kellison, 2019, p. 105).

Finally, the present study would like to suggest the source of funding served as another distinct aspect of the Stage 3 venue as many projects received some level of government support. In Stage 2, local business leaders and alumni were substantial opinion leaders in the construction of new stadia as they were often the source for funding (Seifried, Evans, & Mosso, 2018). However, with the advent of the Great Depression in October 1929 businesses failed, unemployment rose, and/or wages decreased to limit spending on discretionary goods, of which sport is classified (Lucas & Smith, 1978). The national average income was cut in half from 1929 to 1932 resulting in attendance dropping by over 30% (Lucas & Smith, 1978; Watterson, 2002). To combat unemployment and lost wages, the federal government implemented programs like the Works Progress Administration (WPA) and the Public Works Administration (PWA). These programs are notable because the government provided millions of dollars to cities and institutions of higher education for large-scale public projects that offered people employment for an extended period of time based on need (Cozens & Stumpf, 1953; Lucas & Smith, 1978). In the case of the PWA, approximately $40 million was spent on the improvement of athletic facilities (Lucas & Smith, 1978). Furthermore, between 1935 and 1942, roughly $1 billion was awarded by the WPA to build sport and recreation facilities (Cozens & Stumpf, 1953).

The current research found the Federal Government funded over 30 projects primarily within two geographic clusters (i.e., South and West) suggesting they became an important opinion leader by refusing and awarding projects to universities. Both clusters involved several renovations to existing permanent structures, along with some new construction. Again, the neighborhood effect seems strong, as schools in close proximity to each other adopted the aforementioned innovations within a short period. For both regions, these renovations added

several thousand seats to the existing structures but for the South these renovations were potentially more meaningful. Bringing the size of stadiums in the South to be more in line with stadiums in the Northeast and Midwest helped to challenge their perspectives about their region (Doyle, 1994). For instance, Doyle (1994) proclaimed "staging mass market sporting events in modern stadiums was a highly visible way to showcase the progressive urban society of the 20th century South" (p. 243-244). Downs, Tutka, Seifried, and Dean (2019) also suggested that such renovations and new constructions in the South also helped them establish traditions and bonds with their region that simultaneously communicated information about the "significance of their institution, modernity, and ways of life to community folk, alumni, and regional or intersectional opponents pilgrimaging or visiting the facility" (p. 207).

Stage 4: 1947-1984

Following the building activity of the 1930s, there was little change during World War II as building materials were redirected to service the war effort (Seifried, 2016). However, after World War II, massive stadium expansions were common for a variety of reasons. First, the Servicemen Readjustment Act of 1944 (i.e., GI Bill) provided thousands of returning soldiers from World War II the opportunity to attend college, thus flooding university campuses with new enrollments. The additional enrollments prompted more construction through rationalization that more students would want to attend games and that more students meant more alumni produced. A second reason for new building activity post-World War II involved improvements to the transportation infrastructure (e.g., roads) throughout the U.S. With easier access to campuses, it was assumed more people could want to attend contests. Of note, football was promoted heavily during World War II as a sport with resounding synergy with military operations. Therefore, the mass mobilization and training of soldiers often included exposure and opportunities to participate in and consume information about football, which increased interest in the game (Seifried, et al., 2017).

With respect to facility construction, the present study found a total of 461 projects (i.e., 59 new construction and 402 renovations) occurring during Stage 4. Further, it was discovered that the breakdown primarily involved rehabilitations but interestingly, a significant number of preservation projects began to appear in the latter part of Stage 4. As stadiums aged, universities were forced to choose between spending money on preserving and rehabbing the existing structures or building new venues. Many opinion leaders likely chose renovation based on the heritage built into the facility. Further, alumni donations, state tax dollars, or revenue bonds based on promised receipts from a growing number of sources (e.g., concessions, parking, stadium dormitories, sponsorships, radio and television income) served to fund constructions.

The key features of rehabilitated stadia during this era obviously include the expansion of seating and corresponding additions with restrooms, concession stands, and parking spaces. Further, scoreboards continued to advance into larger more expensive and complex structural additions to stadia with their ability offer a variety of electronic-based information, spectator messaging, and sponsorship signage opportunities. However, from a technological perspective, the rehabilitation of press boxes and the field of play stand out as the most notable innovations.

As Stage 4 progressed, newspapers required more accommodations for their equipment. Further, the development of university sport radio networks compelled the creation of more broadcast space because they helped to produce revenues and publicity (Seifried, Faulkner, Baker, & Piker, 2016). Next, through such expansion, president's boxes were created. As large

enclosed private spaces with access to restroom and catering services, president's boxes were precursors to luxury suites to watch games, facilitate alumni relationships, and engage in interpersonal communication with visiting opinion leaders from other schools.

Finally, in the press box, it appears television started to play a role in stadium construction. In 1939, roughly 1,000 spectators watched the first football broadcast on television (Patton 1984; Whittingham, 1984). Notably, World War II interrupted significant development in the technology but within five years after World War II ended, nearly 4 million American households owned televisions (Cokeley, n.d.). Notre Dame was one early adopter of television. For instance, during the 1948 season, Notre Dame allowed multiple companies to broadcast their games and earned $1,800 for each home game along with another $6,600 for the Navy football contest held in Baltimore (Smith, 2001). Recognizing the potential of television, Notre Dame agreed to a contract with Du Mont Television, which provided the school a minimum of $36,000 and an additional $2,150 for every extra station Du Mont could secure for the home schedule ("Du Mont Television," 1949). In places where television broadcasts took place, attendance notably declined from 1947 to 1950 ("Attendance Figures in,"1951). Many universities attributed the attendance decline to increased television coverage (Dunnavant, 2004). This prompted discussion amongst opinion leaders in various conferences and across the NCAA on who should control the sale of television broadcast rights and what television facilities should look like in stadia (Smith, 2001).

In an example of hierarchical diffusion, universities were eventually awarded broadcasts as part of future NCAA television packages (Dunnavant, 2004; Smith, 2001). The 1952 television contract was worth $1.14 million to the NCAA member schools and guaranteed approximately one broadcast each week (Dunnavant, 2004). Universities with historically strong football programs were encouraged to develop spaces for television in order to get part of the money earned through the television deal. However, small less-prestigious football playing schools and conferences either did not develop space for television or created smaller space for broadcasters and their equipment to enjoy. Beyond the production of a new revenue source, the present research suggests television also influenced the speed of diffusion for other innovations. In essence, for the first time, interested spectators and opinion leaders from around the country could directly view and learn about stadium improvements at other universities via television.

Of note, we believe television provided opinion leaders the opportunity to see the development of scoreboards, president boxes, and tailgating scenes. However, we discovered the diffusion of artificial turf was greatly impacted by television. Artificial turf was incorporated into the Houston Astrodome in 1966. Broadcasts of the Major League Baseball (MLB) games during 1966 and 1967 exposed hundreds of millions of spectators to the new surface. Descriptions of that surfaced suggest it lowered maintenance costs, reduced injury rates, and produced more consistent television images (Lashbrook, 1971). This was attractive to many institutions, particularly as costs for maintaining college sports continued to rise during Stage 4 (Lashbrook, 1971). Overall, the present study found several schools (n=79) across all regions adopted artificial turf with little to no neighborhood effect. However, high prestigious football-playing gatekeepers were quicker to adopt the innovation than lower prestigious football-playing peers.

Stage 5: 1985-2019

Finally, similar to Stage 4, fewer new venues (n=22) and more renovations (n=740) occurred during Stage 5. Some new stadiums were developed by universities (e.g., Baylor,

Houston, Minnesota, Tulane) with significant football heritages while other new constructions were built for institutions with more recently established football programs (e.g., Florida Atlantic, Central Florida, Florida International, Georgia State, Charlotte, and Old Dominion). Collectively, these construction activities focused on attempting to produce revenue, brand/rebrand their school, cultivate a unique campus spirit, attract enrollments, and maintain or create alumni, sponsor, and media partnerships (Tutka, 2016).

Like previous stages, both new construction and renovations focused on improving stadia amenities such as number and quality of restrooms and concession stands. Furthermore, the various types of seating options were a significant change. For instance, Stage 5 facilities offer luxury suites, club seats, covered bleacher/grandstand sections, standalone student sections, and disabled seating following passage of the Americans with Disabilities Act (1990), which required 1% of all new facility seating to be reserved for people with disabilities (Tutka, 2016). To support engagement with spectators throughout the facility high-definition videoboards replaced scoreboards and LED ribbon board surrounded the interior of many Stage 5 stadia, with high-prestigious gatekeeper institutions embracing the new additions before lower prestigious peers. In union with large advertisements, which also help to enclose facilities, the Stage 5 videoboards surfaced to generate a significant amount of revenue. Finally, we characterize Stage 5 venues by their focus on upgrading media capabilities and core participant experiences (e.g., locker rooms, training spaces, academic services, office space, and playing field).

Although Stage 5 college stadia were commercial facilities, similar to the "fully loaded" stadiums offered by professional sport leagues, schools typically achieved this stage through the choice to renovate over building new. Again, as in the previous stage, this is likely due to the notion that the accumulation of heritage with annual pilgrimages to schools positioned stadia as social anchors. Not willing to lose the benefits associated with a particular location and facility, rehabilitation projects remained prominent; however, preservation efforts also noticeably increased over Stage 4. For instance, this work found at least 50 preservation projects occurred in Stage 5. Reconstruction also occurred more in Stage 5 with major football-playing universities out West (e.g., Washington, California, Stanford) representing a substantial number.

Renovations in Stage 5 were very much tied to the relative social system the university was a part of, based on conference alignment. Schools that were part of the current Power 5 (i.e., ACC, Big 10, Big 12, Pac-12, and SEC) tended to develop renovation projects similar to other member institutions of those conferences. Lesser prestigious football playing conferences (i.e., Group of 5- AAC, Conference-USA, MWC, MAC, and Sun Belt) followed behind and were often similar to each other. Overall, we found the stadium 'arms race' is real but different among the two groups (i.e., renovations in MAC were likely to be similar to those occurring in the MWC, while renovations occurring in the Big Ten were likely to be similar to those occurring in the SEC). The reasons for this were significantly related to the relative financial positions of the institutions. In particular, Power 5 institutions could gain significantly more revenue from their television contracts and luxury suites/club seats than non-Power 5 schools due to higher demand and larger alumni bases and fan nations (Seifried et al., 2018; Seifried & Kellison, 2019).

With regard to television, the *NCAA v. Board of Regents* (1984) marked the end of Stage 4 and beginning of Stage 5. The aforementioned series of NCAA television plans with various networks violated the Sherman and Clayton Antitrust Acts, which prohibited groups like the NCAA from restraining trade and open competition by its members. With the advent of cable and superstations (e.g., ESPN, TBS), universities and/or their conferences were primed to create their own exclusive agreement to share revenues for their collective benefit (Tutka, 2016). This

meant that conferences became the most important social system prompting subsequent changes to facilities. Interpersonal communication between schools and the conference headquarters became integral to the success or failure of the conference, invitations to join leagues as they expanded, and in establishing the criteria that made for a legitimate stadium (Seifried & Bolton, 2017). In the case of television, subsequent NCAA contracts increased as television ownership continued to soar from the 1950s into the 1970s expanding from approximately 10 million in 1951 to nearly 75 million by 1980 (Cokeley, n.d.). Thus, by the 1980s, television was generating over $250 million over the four-year period from 1982 to 1985 (Dunnavant, 2004). Yet, conferences and individual schools felt they could do better on their own from a revenue generating perspective rather than relying on the NCAA to negotiate agreements. This opportunity and belief prompted significant renovations involving the updating and expanding of space for television broadcasts in press boxes and throughout the facility with the installation of multiple camera locations. Today, several conferences have their own television network and contracts with major networks such as Fox, ESPN/ABC, and CBS that produce billions annually for higher education (Tutka, 2016).

Following the impact of television, most universities also sought to incorporate luxury suites and club seats primarily through funding supported by their athletic association or school foundation (Tutka, 2016). Luxury suite and club seats were introduced with professional sport facilities in the 1960s and 1970s respectively; however, it was not until the late 1980s that those seating options became popular in colleges (Tutka, 2016). Luxury suite and club seating sales became significant because they provided "universities with an exclusive, high-dollar revenue stream that that flowed entirely to themselves; it was not diluted through NCAA control, conference revenue-sharing mechanisms, or the peculiarities of individual game contracts" (Seifried, et al., 2018, p. 65). Within, several other additional benefits emerged. For instance, luxury seating helped universities establish and maintain relationships with potential and current alumni and/or regional and national businesses, who could not only contribute to athletic coffers but general university giving campaigns (Chen & Zhang, 2011; Park, Kim, Sagas, & Eddosary, 2016). In return, suite owners found advantages through opportunities to publicize their leases as charitable contributions but also tangible benefits like signage, stadium/field naming rights, and privileged access to the university and team (Park et al., 2016). Overall, luxury suite owners should be viewed as an emerging opinion leader for the diffusion of luxury amenities.

Finally, by the 2000s, virtually every FBS game played each week was televised or live streamed on the Internet, thus providing opportunities for other non-regional schools to learn about innovations embraced within stadia. Within this point, the Internet and emergence of email should not be discounted as both interpersonal and mass communication tools (Partridge, 2008). The Internet and mobile mass media (e.g., phones and laptops) in general appears to have radically improved the spread of innovations by reducing the impact of physical geography. For instance, universities could provide detailed renderings and even computer animated vides of new or renovated facilities to specific individuals or the public through television, the Internet and email to facilitate knowledge transfer. Furthermore, associated engineering and architectural firms (i.e., Brassfield & Gorrie, HKS, HOK, Populous, etc.) also produced websites and brochures about the coming renovations to provide information and promote competencies.

Conclusion

The present study provided information on several different innovations that impacted the physical development of stadia. Within, various environmental influences were acknowledged as prompting the selection and incorporation of specific innovations. Next, the current research discovered what communication channels (e.g., radio, television, newspapers, Internet) facilitated stadium construction and how the timing of their introduction was connected to the diffusion of innovations. Regarding this point, a critical finding of the present work is that visual and instantaneous forms of mass communication are associated with increases in the rate of innovation diffusion (e.g., artificial turf, luxury suites/club seating, video boards) and more impactful than physical geography over time but only with similarly resourced schools. Some opinion leaders and gate keepers/conferences were also recognized as more significant in some eras versus others from a regional perspective, thus supporting the neighborhood effect.

For the future, the patterns shown in this study suggest multiple considerations. First, maintaining a high-quality and number of restrooms, concession stands, and parking spaces will be critical. Second, the offering and successful sale of luxury seating will be critical to financial success. Third, communication technology will continue to be significant. As stadia developed into broadcast studios for remote attendees through radio, television, and the Internet, it appears they will also need upgrades related to improving connections and capabilities for mobile communication devices. In this point, stadia will need to improve wireless capacities to satiate potential attendee preferences to simultaneously consume games while communicating with others and/or downloading information or videos among others activities they engage. Overall, it is advisable for practitioners of athletic departments to be responsive and willing to adapt to various environmental cues or conditions.

Next, it appears, based on the multiplication of applications (i.e., apps), conference and television networks, and the subsequent competition for viewers within, both live and remote spectators will desire to be more in-charge of their own consumption experience. Thus, practitioners should provide both live and remote spectators the opportunity to control camera angles, statistical information, and interaction with others and possibly the event or core product seems likely (Seifried, 2011). Examples of this currently include participation in promotional contests, posting photos, and reporting accidents/safety concerns, among other activities. However, the future could find apps and engagement interactions as influential on impacting the core event (e.g., music selected, elevating crowd noise, play call selection, etc.) (Seifried, 2011).

Another recent trend unveiled in the present study suggests, preserving heritage is important and likely in future renovation considerations. Specifically, we anticipate more athletic departments will engage in renovations focused on preservation but also might increasingly incorporate halls of fame and potentially guided tours of facilities for commercial purposes. Professional sport stadia have already provided a blueprint for practitioners on how this could be done and highlight this as a lucrative source for revenue, publicity, and relationship-building (Seifried & Meyer, 2010). Of note some colleges have recently been successful creating such additions to their facilities (e.g., Arkansas, Seifried et al., 2016; Georgia Tech, Seifried & Kellison, 2019; Ole Miss, Seifried & Novicevic, 2015). We anticipate and suggest the most well-resourced of institutions will increasingly incorporate such additions first. However, lower prestigious football-playing schools should support this activity to generate interest in their program, facilitate alumni support and recognition, and boost publicity.

Recent trends in facility construction also imply rehabilitation projects will continue to focus on attracting student-athletes and coaches and improving accommodations for them. Many recent renovations involve stadium additions, which include expanded locker rooms and training rooms, academic service buildings, and coaches' offices (Seifried et al, 2016; Seifried & Kellison, 2019; Seifried & Novicevic, 2015). Furthermore, space for hosting recruits, media personnel, and receptions (e.g., planned meetings, reunions, banquets) will be a priority to help attract outside business and attention to institutions because those spaces can serve as important entrepreneurial locales on non-gamedays and places for facilitating and maintaining relationships with important donors, community leaders, and local citizens (Seifried & Kellison, 2019).

Finally, with new dynamic that the world pandemic produced in 2020, sport facilities are surely going to be effected. Recent trends demonstrated by institutions in the West (e.g., Stanford, Arizona State, and California) and by schools with stadia seating over 100,000 (e.g., Penn State and Tennessee) suggest stadiums could begin to shrink, not just for the provision of better amenities but now to possibly reduce the number of people exposed to each other. Large social spaces that have been a feature of recent changes to sport stadia and arena may need to reconsider their physical arrangement to be responsive to this new and emerging environmental cue. In this, it may be beneficial to offer better virtual social spaces rather than more physical space. Moreover, it may be necessary to offer more cleaning stations (not just restrooms) around the facility to help individuals reduce the likelihood of disease transmission. Lastly, television partners will not want to see empty seats as they do not often compel people to consume sporting events. Thus, production space in stadia may need to change to help create computer generated images (CGI) of fans, crowd noise, band music, and other activities that historically have been important to attracting people to both attend and watch games on television and other Internet service platforms. Major League Baseball and professional soccer are currently experimenting with CGI technology to improve the broadcast experience for remote spectators in order to give the illusion that fans are in the stands (Boren, 2020).

References

Attendance figures in major conferences for 1950. (1951). Papers of the Office of the President, 1950-1955. University of Pennsylvania Archives (Box 53, Folder 'Intercollegiate Athletics, TV 2'), University of Pennsylvania, Philadelphia, PA:

Bale, J. (1984). International sport history as innovation diffusion. *Canadian Journal of History of Sport, 15*, 38-63.

Barnouw, E. (1966). *A tower in Babel.* New York: Oxford University Press.

Blanton, W. A. (2014). *Beyond the playing field* (Doctoral dissertation, University of Michigan). Retrieved from http://babel.hathitrust.org

Boren, C. (2020, July 23). Fox Sports will use virtual fans in the stands for its MLB telecasts. *Washington Post*, Retrieved from https://www.washingtonpost.com/sports/2020/07/23/fox-sports-will-use-virtual-fans-stands-its-mlb-telecasts/

Brophy, A. L. (2013).Introducing applied legal history. *Law and History Review, 31*(1), 233–240.

Camp, W., & Deland, L. F (1896). *Football*. Boston, MA: Houghton, Mifflin, Co.

Carey, M., & Mason, D. S. (2014). Building consent. *Managing Leisure, 19,* 105-120.

Chambers, B. B. (1926, September). Night football at the University of Cincinnati. *The Athletic Journal, 7,* 32.

Chen, K., & Zhang, J. (2011). Examining consumer attributes associated with collegiate athletic facility naming rights sponsorship. *Sport Management Review, 14,* 103-116.
Cohane, T. (1951). *The Yale football story.* New York: Putnam Company.
Cokeley, G. (n.d.). Number of tv households in America: 1950-1978*, The American Century*, Retrieved from https://americancentury.omeka.wlu.edu/items/show/136
Compagni, A., Mele, V., & Ravasi, D. (2015). How early implementations influence later adoptions of innovations. *Academy of Management Journal, 58,* 242-278.
Cozens, F. W., & Stumpf, F. S. (1953). *Sports in American life*. Chicago: Cambridge Press.
Crowley, J. (2006). *In the arena: The NCAA's first century.* Indianapolis, IN: NCAA.
Damanpour, F., & Schneider, M. (2009). Characteristics of innovation and innovation adoption in public organizations. *Journal of Public Administration Research and Theory, 19,* 495-522.
Dearing, J. W. (2009). Applying diffusion of innovation theory to intervention development. *Research on Social Work Practice, 19,* 503–518.
Deephouse, D. L., & Suchman, M. (2008). Legitimacy in organizational institutionalism. In R. Greenwood, C., Oliver, R., Suddaby, & K. Sahlin (Eds.), *The SAGE handbook of organizational institutionalism* (pp. 49-77). Los Angeles: SAGE.
Dewett, T., & Jones, G. R. (2001). The role of information technology in the organization: A review, model, and assessment. *Journal of Management, 27,* 313-346.
de Wilde, A., & Seifried, C. (2018). Sport history and sport management in the United States: Opportunities and challenges. *Journal of Sport History*, *45*(1), 66-86.
de Wilde, A. & Seifried, C. S. (2012). An analysis of research methods in leading sports management journals: The dearth of historical methods in sports management. *International Journal of Sport Management, 13*(2), 1-17.
de Wilde, A., Seifried, C. S., & Adelman, M. L. (2010). The culture of history in sport management's foundation: The intellectual influence of Harvard Business School on four founding sport management scholars", *Quest, 62*(4), 406-422.
Downs, B., Tutka, P., Seifried, C.S., & Dean, C. (2019). The development of TCU football and its early stadia. *Southwestern Historical Quarterly, 123,* 204-223.
Doyle, A. (1994). 'Causes won, not lost': college football and the modernization of the American south. *The International Journal of the History of Sport*, *11*(2), 231-251.
Du Mont television network proposal (1949). Vice President John Murphy Papers, University of Notre Dame Archives (Box 4, Folder 'TV'), Notre Dame University, South Bend, IN.
Dunnavant, K. (2004). *The fifty-year seduction.* New York, NY: Thomas Dunne Books.
Edwards, H. (1984). The collegiate athletic arms race: Origins and implications of the "Rule 48" controversy. *Journal of Sport and Social Issues. 8,* 4-22.
Energy efficiency and sustainable design standards for new Federal buildings. (2010, May 28). *Federal Register, 75,* 29933-29947.
Engineer explains how play-by-play description of Harvard-Yale game will be put on the air from the bowl in New Haven. (1926, October 17). *New York Times,* p. 210.
English, P. (2016). Twitter's diffusion in sports journalism. *New Media & Society*, *18*(3), 484-501.
Farmer, Z. (1926, October). The Los Angeles Coliseum. *The Athletic Journal, 7,* 14-15, 42-46
Gaul, G. M. (2015). *Billion-dollar ball.* New York: Viking Press.
Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organizations. *The Milbank Quarterly, 82*, 581-629.
Hardy, S., Loy, J., & Booth, D. (2009). The material culture of sport: Toward a typology. *Journal of Sport History, 36*(1), 129–152.
Hong, S. I. (2012, April 8). *Innovation diffusion in professional sports.* (Doctoral dissertation, Florida State University). Retrieved from diginole.lib.fsu.edu/etd.

Ingrassia, B. (2012). *The Rise of the gridiron university.* Lawrence, KS: University Press of Kansas.
Johansson, O. (2011). The spatial diffusion of green building technologies. *International Journal of Technology Management & Sustainable Development, 10,* 251-266.
Kahn, L. H. (2007). Markets: Cartel behavior and amateurism in college sports. *The Journal of Economic Perspectives. 21,* 209-226.
King, M.T. (2012). Working with/in the archives. In S. Gunn & L. Faire (Eds.), *Research methods for history* (pp. 13–29). Edinburgh, UK: Edinburgh University Press.
Lashbrook, L. (1971). The facts about fake grass. *Journal of Health, Physical Education, Recreation*, *42*(9), 28-29.
Lanzolla, G., & Suarez, F. F. (2012). Closing the technology adoption-use divide: The role of contiguous user bandwagon. *Journal of Management, 38,* 836-859.
Lewis, G. M. (1965). *The American intercollegiate football spectacle, 1869-1917.* (Unpublished doctoral dissertation). University of Maryland, College Park, MD.
Lucas, J. A., & Smith, R. A. (1978). *Saga of American sport.* Philadelphia, PA: Lea and Febiger.
Mayer, K.C., Morse, A.L., & DeShriver, T. (2017). Intercollegiate football luxury suits: An investigation of factors related to price. *Sport Marketing Quarterly, 26*, 75-86.
NCAA v. Board of Regents of Regents of the University of Oklahoma, 468 U.S. 85 (1984).
Oriard, M. (2001). *King football.* Chapel Hill, NC: The University of North Carolina Press.
Oriard, M. (1995). *Reading football.* Chapel Hill, NC: The University of North Carolina Press.
O'Toole, K. M. (2013). John L. Griffith and the commercialization of college sports on radio in the 1930s. *Journal of Sport History, 40*, 241-257.
The Palmer Memorial Stadium at Princeton University (1914). *Engineering News, 72,* 1184- 1187.
Park, C., Ko. Y. K., Kim, H. Y., Sagas, M., & Eddosary, M. (2016). Donor motivation in college sport: Does contribution level matter? *Social Behavior and Personality, 44,* 1015-1032.
Partridge, C. (2008). The technical development of Internet email. *Annals of the History of Computing, 30*(2), 3-29.
Patton, P. (1984). *Razzle-dazzle: The curious marriage of television and professional football.* Garden City, NJ: Dial Press.
Pfleegor, A. G., & Seifried, C. S**.** (2015). Mississippi State's Davis Wade Stadium: The modernization of a football stadium. *Journal of Mississippi History, 77,* 147-176.
Presbrey, F., & Moffatt, J. H. (Eds.). (1901). *Athletics at Princeton.* New York: Frank Presbrey Co.
Radio to broadcast football games. (1923, October 21). *New York Times,* p. 164.
Rogers, E. M. (2003). *Diffusion of innovations.* (5th ed.). New York: Free Press.
Rowlinson, M., Hassard, J., & Decker, S. (2014). Research strategies for organizational history. *Academy of Management Review, 39*, 250-274.
Seifried, C. S. (2017). Peer reviewing historical research for sport management. *International Journal of Sport Management, 18*(4), 461-487.
Seifried, C. S. (2016). The development of Death Valley in Louisiana: The modernization of Tiger Stadium. *Louisiana History, 57,* 184-219.
Seifried, C. (2011). Sport facilities as a broadcast studio for human extensibility? *Journal of Sport Management, 25,* 515-530.
Seifried, C. S. (2010). Introducing and analyzing historical methodology for sport management studies. *International Journal of Sport Management, 11*, 1-21.
Seifried, C. S., & Bolton, C. (2017). The University of South Carolina football stadia through the founding of Williams-Brice Stadium. *South Carolina Historical Magazine 118*, 289-316.
Seifried, C. S., Evans, J., & Mosso, A. (2018). Renown to rubble: The rise and fall of Pitt Stadium as a modern sport venue, 1925-1999. *Journal of Issues in Intercollegiate Athletics, 11,* 51-74

Seifried, C. S., Faulkner, C., Baker, S., & Piker, J. (2016). The development of Razorback and War Memorial Stadiums. *Arkansas Historical Quarterly, 75*(3), 181-205.
Seifried, C. S., & Kellison, T. (2019). The modernization of Grant Field at Bobby Dodd Stadium. *The Georgia Historical Quarterly, 103*(2), 94-126.
Seifried, C., Katz, M., & Tutka, P. (2017). A conceptual model on the process of innovation diffusion through a historical review of the United States Armed Forces and their bowl games. *Sport Management Review*, *20*(4), 379-394.
Seifried, C., & Meyer, K. (2010). Nostalgia-related aspects of professional sport facilities. *International Journal of Sport Management Recreation and Tourism*, *5*(1), 51-76.
Seifried, C. S., & Novicevic, M. M. (2015). Vaught-Hemingway Stadium at Hollingsworth Field and Ole Miss: 100 years in the making. *Journal of Mississippi History, 77,* 115-146.
Seifried, C. S., & Tutka, P. (2016). Southern Methodist University football and the stadia: Moving toward modernization. *Sport History Review, 47,* 172-192.
Smith, H. D. (1920). Report on trip to Princeton, College of City of New York, Yale and Harvard. *The American Architect, 118*(1), 94-96, 160-164, 221-224, 343-345.
Smith, R. A. (2001). *Play-by-play.* Baltimore, MD: The John Hopkins University Press.
Smith, R. A. (1990). *Sports and freedom.* New York: Oxford University Press.
Titlebaum, P., DeMange, D., & Davis, R. (2012). Professional vs. collegiate facilities: Perceived motivations of luxury suite ownership. *Journal of Venue and Event Management*, *4*, 1-12.
Toma, J. D. (2003). *Football U.* Ann Arbor, MI: University of Michigan Press.
Tsitsos, W., & Nixon, H. L. (2012). The star wars arms race in college athletics coaches' pay and athletic program status. *Journal of Sport and Social Issues, 36,* 68-88.
Tutka, P. M. (2016). *An ideal-type through innovation diffusion* (Doctoral dissertation, Louisiana State University). Retrieved from https://digitalcommons.lsu.edu/
Tutka, P., & Seifried, C. (2015). The historical ideal-type as a heuristic device for academic storytelling by sports scholars. *Quest, 67,* 17-29.
Walker, K.B., Seifried, C.S., & Soebbing, B.P. (2018). The National Collegiate Athletic Association as a social-control agent. *Journal of Sport Management, 32,* 53–71.
Watterson, J. (2002). *College football: History, spectacle, controversy.* Baltimore, MD: John Hopkins University Press.
Weeks, K. D., & Grimmer, A. E. (1995). *The Secretary of the Interior standards for the treatment of historic properties.* National Park Service Heritage Preservation Program. Washington, D.C.
Weyand, A. M. (1955). *The saga of American football.* New York: The Macmillan Company.
Whittingham, R. (1984). *What a game they played.* New York: Harper & Row.
Yates, J. (2014). Understanding historical methods in organizational studies. In M. Bucheli and R. D. Wadhwani (eds.), *Organizations in time* (pp. 265-283). New York: Oxford University Press.
Young, C. A. (1886). College athletic sports. *Forum, II*, 142-152.