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Investigating Managerial Priority of Environmental Inputs and Outputs in Public Assembly Venues

Walker Ross

INVESTIGATING MANAGERIAL PRIORITY OF ENVIRONMENTAL INPUTS AND OUTPUTS IN PUBLIC ASSEMBLY VENUES

by

Walker Ross

Bachelor of Arts
University of Portland, 2014

Master of Science
University of Georgia, 2016

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Accepted by:

Haylee Mercado, Major Professor

John Grady, Committee Member

Sam Todd, Committee Member

Kevin So, Committee Member

Cheryl L. Addy, Vice Provost and Dean of the Graduate School

DEDICATION

For my wife Hayley. I appreciate your patience and motivation through this process so much. Now, maybe I can go to sleep at a reasonable hour.

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ABSTRACT

This study was focused on understanding how managers of public assembly venues prioritize the various manager-perceived environmental inputs and outputs of the operation of their building when making decisions on environmental sustainability. Such research is necessary as there was little to no understanding of the operational impacts of sport on the natural environment. A survey of managers of public assembly venues that utilized the best-worst scaling method of experimental design and analysis was utilized to gather data that appropriately addressed the research question posed by this study. Findings suggest that managers prioritize the environmental inputs and outputs of their buildings in the following order from highest to lowest: waste, electricity, use of disposable products, water, food, emissions, gas, chemicals, and oil. These findings provide a clearer understanding of how these public assembly venue managers perceive the environmental impacts of their operations and also provide direction for where solutions to environmental sustainability issues in the venues industry ought to be targeted to achieve maximum buy-in from these managers. Additionally, it helps to provide a conceptual understanding of what the impacts of the operation of such public assembly venues are for future researchers working in this field.

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LIST OF ABBREVIATIONS

BWS .... Best Worst Scaling

CSR .... Corporate Social Responsibility

EMP .... Environmental Management Performance

EOP .... Environmental Operational Performance

EPM .... Environmental Performance Measurement

GSA .... Green Sport Alliance

IAVM .... International Association of Venue Managers

IOC .... International Olympic Committee

ISO .... International Organization for Standardization

LCA .... Life Cycle Assessment

LEED .... Leadership in Energy and Environmental Design

MaxDiff .... Maximum Differential

NHL .... National Hockey League

OGI .... Olympic Games Impact

PAV .... Public Assembly Venue

SE-EPM .... Sport Event Environmental Performance Measurement

SPSS .... Statistical Package for the Social Sciences

USGBC .... United States Green Building Council

CHAPTER 1

INTRODUCTION

Sport and the environment are incredibly impactful on one another. From environmental factors causing concern for certain sports to be played safely (e.g., the FIFA World Cup 2022 in Qatar or pond hockey) to sport, and the larger entertainment industry as well, having an immense impact on their local environment (e.g., construction of new venues for mega-events or fertilizer use on grass fields bleeding into local watersheds), we must be attentive to the needs of both sport and the environment so that they may coexist. Due to this concern, some researchers have turned their attention to addressing the topic of minimizing the harmful impact that sport has on its local environment as well as better understanding environmental sustainability and its role within the sport industry.

Most of the research to date on the subject has addressed one of the following areas: motivations for sport organizations to adopt environmental sustainability, organizational perspectives on environmental sustainability, consumer and spectator engagement with environmental sustainability, and lastly some sport-specific studies with contextualize environmental sustainability within that spot setting. The research that has focused on motivations for sport organizations to adopt environmental sustainability (e.g., Babiak & Trendafilova, 2011; Capser, Pfahl, & McCullough, 2017; Mallen, Adams, Stevens, & Thompson, 2010; Walker, Salaga, & Mercado, 2016) have largely found that the sport industry is motivated by corporate strategy to avoid risks, creating a sense of social legitimacy, and a general response to demand from consumers within the market for such environmental considerations. Meanwhile, those that focus on sport organizational perspectives on environmental sustainability (e.g., Lesjø, 2000; Pentifallo & VanWynsberge, 2012; Pfahl, Casper, Trendafilova, McCullough, & Nguyen, 2015; Samuel & Stubbs, 2012) have found that the emergence of environmental sustainability in sport is a fairly recent phenomenon which is comprised of various stakeholders working together to achieve environmentally sustainable outcomes. Consumers also play an important role in regards to environmental sustainability in sport in that they can be influenced by sport team behavior; however, the internal values, beliefs, and norms of those consumers play an important role in determining the ability of a sport team to influence their behavior in the first place (Casper, Pfhal, & McCullough, 2014; Inoue & Kent, 2012a, Inoue & Kent, 2012b; McCullough, 2013). Lastly, there have been a few studies which have considered the unique environmental sustainability linkages between certain sport settings like disc golf (Trendafilova, 2011), frozen pond hockey (Fairley, Ruhanen, & Lovegrove, 2015), golf (Wheeler & Nauright, 2006), and motorsports (Dingle, 2009).

However, despite the breadth of research topics covered by past research into sustainability in sport, there remains a lack of understanding on the actual environmental impact of the sport live event itself and which of those impacts sport live event managers allocate their resources towards addressing. For example, it is important to understand how the operation of sport live events is influenced by its environment and also how sport live events influence their environment. Further, it would benefit the industry to have an understanding of the specific environmental inputs that sport, and also entertainment, live events require to operate as well as the environmental outputs that they create as a result of their operations. Mallen, Steven, and Adams (2011) as well as Mallen (2018) have both called for future research to address this topic. Thus far, only two studies in the larger sport management discipline have even attempted to even measure environmental inputs and outputs in sport events let alone identify what those inputs and outputs are (Chard & Mallen, 2012; Dolf & Teehan, 2015). The strengths and weaknesses of those two studies will be addressed further in the literature review, but it is important to note now that those two studies have been too narrow in their focus on measuring the environmental inputs and outputs of sport as they only addressed the impact of transportation. Sport and entertainment – and more specifically sport and entertainment live events – have a broader of an impact than just the transportation of teams or spectators.

As the literature currently stands, there is limited information available that can be utilized to build a profile of what these environmental inputs and outputs are in sport and entertainment live event management as well as how they may be measured and evaluated by sport managers. It would then be useful to identify which of those inputs, outputs, and their respective measures are the most valuable for sport or entertainment live event managers when they make decisions on environmental sustainability within their organization. If environmental sustainability is to move forward in sport management, then it will be important to have an understanding of which environmental impacts sport or entertainment live event managers prioritize so that future managers and researchers are able to make better informed decisions on environmental sustainability. As a result, better solutions can be developed that target the specific environmental input and output issues that matter those working in the industry. In particular, it would be wise to examine this phenomenon as it relates to public assembly venues (PAVs) specifically since these are the facilities in which most sport and entertainment live events are held as well as the fact that buildings are responsible for a significant portion of greenhouse gas emissions (Lucon et al, 2014). Therefore, this dissertation sought to address this gap in the literature through a study centered on the following research question: of the environmental inputs and outputs in sport and entertainment live event management, which do PAV managers prioritize when making decisions on environmental sustainability within their building?

The rest of this dissertation will review the known literature that relates to this topic (e.g., the concept of environmental sustainability, the state of literature on environmental sustainability in sport management, available literature and resources on environmental inputs and outputs, life cycle assessment, as well as the best-worst scaling technique), cover the methodology utilized to address the proposed research question, present results of the investigation, and ultimately provide discussion to contextualize the major findings as they related to the literature.

CHAPTER 2

LITERATURE REVIEW

2.1 DEFINING SUSTAINABILITY

Before proceeding into the literature, it is important to first consider what the term "sustainability" actually means. According to *Our Common Future*, which is sometimes called the *Brundtland Report*, sustainability means meeting the needs of today without compromising the ability of future generations to meet their own needs (World Commission, 1987). That definition on its own does not directly address environmental issues, but there is an approach to sustainability that has been termed the 'Triple Bottom Line,' whereby sustainability means having a positive impact on economic needs, social needs, and environmental needs (Elkington, 2004). As such, sustainability's relation to environment comes from the fact that our human activities require taking resources from our environment and conducting activities that will ultimately have an impact on our local environment. We must be careful to only create environmental impacts that we can manage so that future generations are not left without the means to provide for their own needs. More specifically than the above definition of sustainability, Cavagnaro, Postma, and Neese (2012) provide one that is more specific to event management. This definition is perhaps better suited for the sport and entertainment industries in general since they are largely – though not wholly – industries of live events (e.g., games, concerts, and family shows). Cavagnaro and colleagues' definition suggests that sustainable events are those which provide a net positive impact for all involved stakeholders in the event (Cavagnaro et al, 2012). In this definition, for a sport or entertainment live event to be sustainable, it would have to make money for the organizers, be enjoyable for guests, not harm the local environment, and be held safely, along with many other issues that would be of concern to sport or entertainment live event stakeholders. Ultimately, sustainability in live events seeks to limit the negative outcomes and maximize the positive outcomes of a concept Preuss (2007) called 'legacy:' the planned and unplanned, tangible and intangible, positive and negative structures left after an event has concluded.

However, this study focused on not just sport or entertainment live events in general, but the facilities in which they are typically held: PAVs. There is an even more specific definition of sustainability available that addresses PAVs and their role in sustainability. This sustainability definition comes from the International Association of Venue Managers (IAVM), which is an organization for those who manage PAVs like sport stadiums and arenas, performing arts centers, convention centers, and other facilities in which large groups of people can gather:

> The ability of public assembly facilities to fulfill client and industry needs whilst exercising environmental responsibility through the use of green standards, application of technologies, processes, practices, and related business implications – balancing the fulfillment of human needs, now and for generations to come, while enhancing the health of ecosystems and the ability of other species to survive in their natural environments. (IAVM, 2017a)

The above definition of sustainability suggests a middle green ethical approach to the environment from the IAVM where human interests are still accounted for while displaying a reverence for the value of life beyond humanity (DeSensi & Rosenberg, 2010). In other words, this definition of sustainability displays neither a purely anthropocentric perspective on the environment nor an ecocentric perspective. It is between those two. This definition also potentially suggests what it is that PAVs value – or place emphasis upon – when it comes to sustainability: "fulfilling client and industry needs" while "balancing fulfillment of human needs" against those of "other species" (IAVM, 2017a).

It is important to note that this particular review of the literature is solely concerned with environmental sustainability. Not all literature on sustainability considers environmental impact, and therefore only the literature which does examine environment will be discussed. As such, use of the term "sustainability" in this dissertation shall be limited to the notion of environmental sustainability. For now, with these definitions of sustainability (specifically environmental sustainability) in mind, it is important to cover the brief history of literature in this field.

2.2 ENVIRONMENTAL SUSTAINABILITY IN SPORT MANAGEMENT

As noted in the introduction, research in the fields of sport, entertainment, and environmental sustainability is relatively new. In fact, one of the earliest articles on the subject comes from Cachay (1993) who started to ask the question: can sport continue to negatively impact its environment and still be played in the future? This was an important question to ask because it helped to jumpstart research into this field. In the time since, at least seventy articles on the subject have been published in sport management-related journals which have largely focused on the management side of the field and not on the application of environmental sustainability in sport or entertainment live event management or PAVs. Among those seventy-plus articles have been three attempts to review the state of the literature in the field. Mallen, Stevens, and Adams (2011) first provided a content analysis of environmental sustainability research in sport management by examining all published articles on environment, sustainability, and green in sport-related journals from between 1985 and 2008. Journals included in this study were the *Journal of Sport Management*, *European Sport Management Quarterly*, *Sport Management Review*, *Sport in Society*, *The International Review for the Sociology of Sport*, along with many others. Mallen and colleagues (2011) found that only seventeen articles had been published on the subject in those journals during that timeframe. It should be noted that Mallen and colleagues used 'green' and 'sustainability' in their search criteria which yielded several studies which addressed 'green' and money or 'sustainability' as social and economic sustainability. Thus, there may be even fewer articles on the field that their searches revealed. However, what research has been completed, can still be discussed.

The findings in the Mallen and colleagues (2011) study were organized into two themes: environmental management performance and environmental operational performance. These themes were based upon the Sport Event Environmental Performance Measurement (SE-EPM) proposed by Mallen, Stevens, Adams, and McRoberts (2010) which was modified from the Environmental Performance Measurement (EPM) tool originally proposed by Xie and Hayase (2007) for the electrical machinery and instrument manufacturing sector (both the EPM and SE-EPM will be explored in the sections that follow). Under the first theme were the subthemes of an introduction to environmental sustainability, which stakeholders are involved in environmental sustainability in sport, environmental operational countermeasures that sought methods of decreasing that environmental impact of sport, and environmental tracking. All seventeen articles were found in this first theme and were more specifically present under the first three subthemes (Mallen et al, 2011). Subtheme four on environmental tracking was defined based on the SE-EPM and EPM as: "tracking energy use, financial resource use, general wastes, water drainage, air and water pollution, greenhouse gases, and compliance" (Mallen et al, 2011, p. 245). As such, there were no articles at the time that attempted to identify, define, or study these measures of environmental performance in a sport context. This is a striking omission by the research since these measurements are some of the most basic tools for analyzing the environmental impact of any activities.

Since all of the articles analyzed were in those first three subthemes, it also means that there were no articles at all under the environmental operational performance theme. There are two subthemes under this: environmental inputs and environmental outputs. Environmental inputs is defined as the measurement of resources required for the operation of the sport organization (e.g., oil, gas, electricity, water, raw materials, paper, chemicals, and food) while environmental outputs are defined as being the measurement of byproducts produced as a result of the operation of the sport organization (e.g., waste disposed, emissions, water drainage, and pollution created (Mallen et al, 2011). As of the publication of this article in 2011, sport management research had not attempted to identify, define, or otherwise analyze these environmental inputs and outputs of a sport organization. This is also a major shortcoming since aside from having the motivation to engage with environmental sustainability or an understanding of organizational or consumer impacts of environmental sustainability, it is important to have the operational knowledge of how to actually implement environmental sustainability and how to evaluate its performance. Mallen and colleagues (2011) suggested that future research ought to address this shortcoming. However, much time has passed and much more research has been published since the final year of the scope of that review of the literature, which was in 2008.

Mallen followed up this review of the literature by performing a repeat of her methods in a 2018 book chapter that examined environmental sustainability research in sport management from 2009 to 2015 (Mallen, 2018). For this review, there were 53 new articles on environmental sustainability in sport that had been published. But, similar to the previous review, all were focused on the environmental management performance theme and not the environmental operational performance theme. Thus, the gap on inputs and outputs remains for this research. However, two articles had been published which fit under the subtheme of environmental tracking (i.e., Chard & Mallen, 2012; Dolf & Teehan, 2015), which will be discussed in the next section.

Despite this second review of the state of published research on environmental sustainability in sport, another review of the state of research on the topic was published at the same time from Trendafilova and McCullough (2018). The stated objectives of this review of the literature were to identify the scholarly research published on the subject, determine the primary efforts of practitioners with regard to environmental sustainability, and to see where there is overlap or gaps between the research and practitioners. This review of the literature covered all research published in English between January 2007 and September 2017 in sport management-related journals (Trendafilova & McCullough, 2018). Articles that did not meet this set of requirements (i.e., published, in English, in the timeframe, and in sport management-related journals) were excluded. Practitioner efforts were determined by examining the materials, webinars, and conferences offered by the Green Sport Alliance (GSA), which is an organization offering sport practitioners information on practices and knowledge relating to integrating environmental sustainability into the sport industry (GSA, 2018a). Categories that organize the findings were developed through a thematic coding process, which yielded the following categories that the research articles were grouped within: management (16 articles), spectators (10), facilities (8), marketing and communications (4), performance evaluation (3), and social sustainability (2) (Trendafilova & McCullough, 2018). Findings from Trendafilova and McCullough's (2018) review of the literature found that there was a significant lack of research on performance and evaluation of environmental sustainability in sport management. This would include an understanding of what these is regarding environmental inputs and outputs that need to be evaluated. The three articles found that fit the performance and evaluation category were from Johnston and Ali (2018), Mallen, Stevens, Adams, and McRoberts (2010), and VanWynsberghe (2015), which will be discussed in next section of this paper.

Collectively, what these three reviews of the literature show is that this field truly is young with most of the research available on the subject having been published within the current decade. This means that there are still many questions worth examining on sport and environmental sustainability including addressing the purpose of the present study of conceptualizing the environmental impacts of the PAVs in which sport and entertainment live events are held to determine which ones PAV managers place emphasis upon when making decisions on environmental sustainability in their building.

However, before moving forward it would be pertinent to review the aforementioned articles that fell under the subtheme of environmental tracking.

2.3 ENVIRONMENTAL INPUTS AND OUTPUTS

Before moving forward to discuss what sport management research has addressed environmental inputs, outputs, and their measures, it is imperative to first understand what environmental inputs and outputs are in general as well as how they are measured. In particular, it is important to contextualize environmental inputs, outputs, and their measures within PAVs, a sport context, or more broadly: buildings. As such, this section will consider research and other literature that exists in fields outside of the sport management discipline.

It would be best to start with an older business management strategy proposed by Welford and Gouldson (1993). These authors originally proposed an environmental impact assessment that was “a framework or methodology specifically developed to minimise the potential environmental impacts of new developments” (Welford & Gouldson, 1993, p. 31). As part of these environmental impact assessments, a business would have to review the following environmental impacts: sites and building management, raw material use, energy consumption, product and services offered, processes utilized, wastes and discharges, transportation and distribution systems, paper and packaging, accidents and emergencies, health and safety, and finally recycling (Welford & Gouldson, 1993). As a part of the development of the environmental impact assessment framework, Welford and Gouldson offer examples of possible measures for these impacts (e.g., use of renewable resources as a measurement for materials or level of direct waste as a measurement for products); however, none of these examples of measures are useful for the present study as those included are not specific measurements designed to evaluate the environmental performance of the impacts suggested. As such, this environmental impact assessment from Welford and Gouldson (1993) offers an idea of what the environmental inputs and outputs of a business or a PAV may be, but do not offer specific solutions or measures.

As was mentioned in the previous section, Xie and Hayase (2007) have proposed the EPM model as a tool in their attempts to evaluate the whole environmental performance of a corporation – specifically those in the electrical machinery and instrument manufacturing sector. Xie and Hayase (2007) drew from Welford and Gouldon's (1993) environmental impact assessment in the creation of their EPM model. The EPM model consists of Environmental Management Performance (EMP) and Environmental Operational Performance (EOP) indicators. The real contribution of the EPM model to an understanding of the environmental impact of a corporation came from the inclusion of EMPs as part of the overall model. This contribution was supported by Olsthoorn, Tyteca, Wehrmeyer, and Wagner (2001) who suggested that the EMPs indicators were too related to EOP indicators to omit them from the model. However, the present study is more focused on EOP and will therefore discuss these indicators. EOP is measured by two operational performance indicators; inputs and outputs (Xie & Hayase, 2007). Inputs are considered to be the resources used or consumed by a company (e.g., water, raw materials, paper, package materials, hazardous chemicals, oil, electricity, and gas) while outputs are refer to the wastes and pollutants generated by the activities of a corporation (e.g., wastes disposed, water discharged, hazardous chemicals released and transferred out, pollutants released into the atmosphere, and water pollutants (Xie &

Hayase, 2007). It is easy to see the similarities between raw materials, energy, wastes and recycling, as well as paper and packaging between Welford and Gouldon's (1993) and Xie and Hayase (2007). Moving forward, the present research will focus upon EOP. It is also important to note that these environmental inputs and outputs within the EOP are measurable environmental impacts of an organization. Inputs are those costs to the environment and outputs are the consequences of production on the environment. Therefore, these inputs and outputs can be considered to be assessments of the environmental impact of the organization in question.

Given that the SE-EPM model from Mallen, Stevens, Adams, and McRoberts (2010) was developed based upon the EPM, the EPM has the same input and output indicators as listed in full in Table 2.1. Xie and Hayase (2007) tested the reliability of their EPM model and concluded that the model was sufficiently reliable; however, the Cronbach's alpha scores for their inputs (0.690) and outputs (0.420) both also fall short of the Mahoney and colleagues (1995) criterion. The EPM, since it is what the SE-EPM was based upon, therefore suffers from the same shortcomings as the SE-EPM model with regard to the measurement of environmental inputs and outputs. Further, since the EPM is meant to measure the environmental performance of an organization (regardless of if that organization produces a good or a service), it does not necessarily fit the profile of a sport or entertainment live event or a PAV. PAVs are a unique context compared to a company that produces widgets since the PAV itself is the product under consideration. Therefore, EPM by itself also comes up short to offering a concrete and reliable understanding of what the environmental inputs and outputs for a building or a PAV may be, but it may offer an indication of what those inputs and outputs may potentially be.

While the EPM and SE-EPM may not be a perfect profile of the environmental inputs and outputs of a PAV by itself, there are other resources to consider that provide a clearer profile of how a building in general may impact its environment. The IAVM resource website on sustainability (IAVM, 2017a) directs viewers to resources from the United States Green Building Council's (USGBC). The USGBC offers a program called 'Leadership in Energy and Environmental Design' (LEED) which certifies buildings for environmental sustainability. As of 2017, over 92,200 projects have achieved at least the minimal level of LEED certification which includes several notable PAVs: Portland's Moda Center, San Francisco's AT&T Park, and Miami's American Airlines Arena (USGBC, 2016). One level of LEED certification the USGBC offers is for building maintenance and operations (USGBC, 2018). This certification program considers the various impacts that a building may have on its environment through its operation (USGBC, 2018). This particular standard evaluates the various inputs and outputs of a building as is required by the present research. Therefore, it is important to consider the full list of impacts shared via this certification, which may be viewed in Table 2.2. The major areas of emphasis for this certification come from location and transportation, sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, innovation, and regional priority (USGBC, 2018). In comparison to the SE-EPM model, one can see overlap in the evaluation of water, energy, wastes, raw materials, chemical usage, and pollution management. This evaluation from the USGBC seems to confirm that the SE-EPM's input and output measures are valid considerations for a building.

There are other resources to consider when building this profile of the environmental inputs and outputs of a PAV that are specific to the sport and entertainment industry. The IAVM resource website on sustainability (IAVM, 2017a) also directs viewers to resources from the GSA who provide a public resource called the "Green Sports Alliance Operations Roadmap" (GSA, 2018b). While this resource does provide insight into the environmental impact of a whole sport organization, it can be considered appropriate for use within the context of PAVs due to the close relationship between many sport organizations and the PAV in which they compete. The Operations Roadmap considers the environmental impacts of energy use, water use, waste management, cleaning and chemical use, purchasing and raw materials, as well as fan engagement (GSA, 2018b).

Another environmental organization that has teamed up with many major professional sport organizations is the National Resource Defense Council (NRDC), who consider the following environmental impacts of a sport organization: energy, water, waste, paper, food, chemicals, travel, building, suppliers, and the front office (NDRC, 2019). Specifically for the building the sport organization might play within, the PAV, the NDRC considers the following areas that might have impacts: the building, heating, ventilation, and air conditioning (HVAC), water recycling and reuse, wood products, green rooftops, energy use, and daylighting of fields (NDRC, 2019). Another resource comes from the National Hockey League (NHL) Sustainability report, which emphasized the impacts of: carbon emissions, energy usage, water usage, waste disposal, and food usage (NHL 2018). And, one final resource comes from the Olympic Games Impact (OGI) reports, which are meant to evaluate the environmental impact of hosting the

Olympic Games mega-event (VanWynsberge, 2015). A recent OGI including the following environmental impacts as part of its evaluation: water quality, wastewater emission, sewage, air quality, land use, wildlife protections, transportation, energy consumption, solid waste, materials usage, green product use, and natural disasters (POCOG, 2016). What can be seen from the GSA, NRDC, NHL, and OGI resources are the consistencies with the SE-EPM and USGBC impacts of energy use, water use, waste management, chemical use, raw material use, and pollution management. However, these other resources suggest that food usage and food disposal are inputs and outputs that ought to be included in the evaluation of the environmental performance of a PAV as well (NHL, 2018; NRDC, 2019). Therefore, moving forward, the SE-EPM model will be utilized as a profile of the environmental inputs and outputs of a PAV with the inclusion of the input of food use and output of food disposal.

With this understanding of what environmental inputs and outputs and their specific measures may include in for a PAV, it is now possible to move forward and consider research from the environmental tracking, performance, and evaluation subthemes from Mallen and colleagues (2011), Mallen (2018) and Trendafilova and McCullough (2018). Therefore, the following section will address such research which takes a closer look at specific issues related to environmental impact assessment in the sport management setting.

2.4 ENVIRONMENTAL TRACKING, PERFORMANCE, AND EVALUATION

According to Mallen (2018), there have been two studies that have touched on the subtheme of environmental tracking. Meanwhile, Trendafilova and McCullough (2018) identified three more. Another study that fits this theme was also discovered and will be discussed in the section that follows. Since this proposal seeks to determine how PAV managers prioritize environmental inputs and outputs in their building, it would be pertinent to review current literature that relates to these questions. The first of those articles sought to examine the environmental impact of automobile travel required for community hockey games (Chard & Mallen, 2012). Sustainability theory was employed to conduct a carbon footprint analysis of automobile travel required to get nine- and ten-year-old boys to their hockey games in Canada. Interviews were conducted with thirty-two parents of these young hockey players in order to build a picture of their automobile use for travel to away games. The information uncovered from these interviews was entered into two carbon footprint calculators in order to determine a measured value of the carbon footprint of the automobile use. The results were presented as the tonnage of carbon dioxide emissions as a result of the automobile use (Chard & Mallen, 2012). This research is helpful for the present study as it shows that a profile of environmental inputs of a sport organization should include the gasoline used by vehicles and could be measured with miles traveled. A profile of environmental outputs should include the emissions of the vehicles, which could be measured by tons of carbon dioxide. However, a weakness of this study, for the purposes of the present research, is that it is narrowly focused on one specific environmental impact of sport activities: driving to and from the event itself. There are many other ways in which a sport or entertainment organization, live event, or PAV may have an environmental impact (e.g., water use and pollution or chemical use and disposal). A wider profile of the environmental inputs and outputs of a sport or entertainment organization is necessary, and this research only addressed one aspect that belongs in that larger profile.

While the Chard and Mallen (2012) study was a potential starting point for further research on environmental tracking in sport management, Dolf and Teehan (2015) as well as Wicker (2018) all built a stronger picture of the measurement of the environmental impact of travel for sport events. Dolf and Teehan (2015) focused on the carbon footprint of spectator and team travel for varsity sport events at a Canadian university was calculated based on a life cycle assessment (LCA). A more rigorous approach to calculating the carbon footprint was used by Dolf and Teehan (2015) when compared to Chard and Mallen (2012) who used online carbon footprint calculators. Dolf and Teehan (2015) used previous research to complete the calculations themselves. Findings from this study suggested that spectators has a smaller per person carbon footprint than a whole team, but a larger overall carbon footprint as a whole. Air travel had the largest carbon footprint. It only accounted for four percent of spectator travel yet contributed over half of the spectator carbon footprint. (Dolf & Teehan, 2015). Several opportunities for reducing the carbon footprint of spectator and team travel are offered based on the results. The strength of this study is that it uses LCA to provide a stronger analysis of the impact of travel for sport events on the environment. It is known that fossil fuels burning by automobiles are one of the largest human-made contributors to air pollution and carbon emissions (Barkenbus, 2010; Nascimento, Yu, Quinello, Russo, de Fátima, Nigro, & Lima, 2009). However, this suffers from the same shortcoming as the Chard & Mallen (2012) study. It should be noted that the use of LCA by Dolf & Teehan (2015) was commendable. LCA would provide a strong theoretical perspective for the present research questions and, as such, will be further explored later in this proposal.

Wicker (2018) used a very similar approach to Dolf and Teehan, (2015) except that the context was within Germany. Online surveys were distributed to adults who were actively participating in twenty different sports. These participants were asked to self-report their sport-travel behaviors. Based on the surveys collected, carbon footprints were calculated by hand using formulas based on information on travel distances and the mode of transportation. Wicker's (2018) results suggested that the average annual carbon footprint of an active sport participant was close to 844 kilograms of carbon dioxide emissions. Interestingly, individual sports produced a larger carbon footprint that team sports and that nature sports (e.g., hiking, climbing) had the largest carbon footprint overall. Another interesting insight offered by Wicker (2018) was that environmental consciousness of the individual was significantly correlated with a reduced carbon footprint in individual sports, which was revealed through regression analysis. There was no correlation found with team, racket, and nature sports. While this study as well as that of Dolf and Teehan (2015) do offer a more rigorous methodological approach to analyzing carbon footprints for sport-related travel, they do not offer any other information on the broader impact of a sport or entertainment organization, live event, or PAV.

Two of the studies suggested in the Trendafilova and McCullough (2018) do provide evaluations of resources for environmental sustainability in sport previously discussed in this literature review. The first, from VanWynsberge (2015) presents various strategies for the successful implementation of the controversial Olympic Games Impact (OGI) tool. This is a tool developed by the International Olympic Committee (IOC) and the International Academy for Sports Science and Technology for use by host cities to evaluate the total impact profile of hosting the Games (VanWynsberge, 2015). Besides the previously discuss environmental indicators that OGI measures, it also consists of economic and socio-cultural indicators (VanWynsberge, 2015). In a similar fashion, Johnson and Ali (2018) evaluated the 2014 NHL Sustainability Report utilizing the concept of ecological modernization in order to examine how environmental stewardship is influenced by the sport industry. In particular, Johnson and Ali (2018) were trying to examine if there was dissonance between the NHL's promotion of its environmental sustainability program and its actual environmental impact. However, the outcome of this research is not of value for the present study. It is important to note that while the other major professional sport leagues in the United States have undertaken environmental sustainability initiatives, they do not publish, nor make available to the public, reports similar to that from the NHL.

It is the last of the studies suggested in the Trendafilova and McCullough (2018) review that is perhaps the most useful for the present study as it considers the environmental performance of an international multi-sport event: the International Children's Games (Mallen, Stevens, Adams, & McRoberts, 2010). This particular article focuses more on the evaluation of total environmental performance of a sport event. Mallen, Stevens, Adams, and McRoberts (2010) collected surveys and interviewed 15 event managers and volunteers in order to evaluate the level of success they had in implemented environmentally sustainable practices in the event. While the results of the study itself do not help build a picture of what those environmental inputs and outputs may be and their level of prioritization, this paper does use the Sport Event Environmental Performance Model (SE-EPM) that was modified from the existing

Environmental Performance Measurement (EPM) model from Xie and Hayase (2007). Within this model are some clues to what those environmental inputs and outputs may be, which are reported in Table 2.1. Mallen, Stevens, Adams, and McRoberts (2010) conducted reliability tests on their SE-EPM model and found that the Cronbach's alpha score for the environmental inputs and outputs (0.13) fell well below Mahoney, Thombs, and Howe's (1995) acceptable criterion of 0.75. This is concerning, since it shows the lack of reliability of this particular set of indicators, which were ultimately left in the SE-EPM model in order to not differentiate it too drastically from the EPM model (Mallen, Stevens, Adams, & McRoberts, 2010).

It is important to note that this SE-EPM tool is meant for use in evaluating the whole picture of the environmental performance of an organization and was utilized to evaluate the environmental performance of an event that moves to a new site each year (Mallen, Stevens, Adams, & McRoberts, 2010). As such, it does include some measurement of the organization's use of environmental inputs and outputs; however, it was not developed with the specific intent of evaluating the environmental inputs and outputs of a permanent building such as a PAV, which may face different environmental challenges than a multi-sport event. A multi-sport event is not hosted at the same building regularly, but is moved from site to site, which may create measurement challenges. Thus, while there are issues regarding the reliability of their measures for inputs and outputs in the SE-EPM model, the model as a whole does not offer any understanding of what those inputs and outputs may be for a regularly-used building such as a PAV. However, it does provide the closest profile of environmental inputs and outputs to what may be found in PAVs due to their relationship with hosting sport events. As such, this paper sought to further address those environmental inputs and outputs for a regularly utilized PAV and determined how PAV managers prioritize those inputs and outputs when making decisions on environmental sustainability within their venue.

While all of these articles provide some insight into what a PAV's environmental inputs, outputs, and their measures may be, there is still a lack of depth to this literature and there has been no attempt to fully investigate how those environmental inputs and output are evaluated by the PAV managers making decisions on environmental sustainability within their building. However, in order to provide a more thorough understanding of environmental sustainability in sport management as it may related to PAVs, other research from the sport management discipline will be considered and connected to the present study. The next section will cover such related literature.

2.5 OTHER ENVIRONMENTAL SUSTAINABILITY IN SPORT

Before proceeding to covering literature on life cycle assessment, best-worst scaling, and ultimately the methodology required to investigate PAV manager emphasis of environmental inputs and outputs, it is important to acknowledge all of the other research that touches on sport and environmental sustainability, as it will help to build an understanding of the current state of research on the subject, as well as why the presently proposed research ought to be considered. This research has largely touched upon three topics: motivations for sport managers to adopt environmentally sustainable practices, organizational perspective on environmental sustainability, and consumer engagement with environmental sustainability. This section will briefly touch upon all of these subjects.

Understanding managerial motivations for adopting environmental sustainability in sport has potentially had the most attention in the literature to date. Many authors have attempted to understand the underlying motivations for wanting to adopt environmental sustainability and most of the research on this topic has found the following motivations regardless of the particular sport stakeholder it concerned: financial benefits, image enhancement, competitive strategy, beating regulations, and pro-environmental values (c.f. Babiak & Trendafilova, 2011; Capser, Pfahl, & McCullough, 2017; Mallen, Adams, Stevens, & Thompson, 2010; McCullough & Cunningham, 2010; Walker, Salaga, & Mercado, 2016). Mercado and Walker (2012, 2015, and 2016) have examined the motivation issue using a values-based approach from the perspective of PAV managers, which is relevant to the present research, and have found that environmental sustainability is often not a value by itself, but is a valuable complement to many other processes in PAV operation. Using a corporate social responsibility (CSR) perspective, Trendafilova, Babiak, and Heinze (2013) found that institutional pressures were often a motivation for adoption of environmental sustainability in sport teams and leagues while Trendafilova and Babiak (2013) also reported that environmental sustainability CSR initiatives may be part of a corporate strategy for defending against risk, promoting social legitimacy, and appreciating market demands. Regarding sport venues specifically, Kellison & Hong (2015) and Kellison, Trendafilova, and McCullough (2015) examined the motivations to adopt environmental sustainability in new stadium construction and found that there are a variety of stakeholders involved in the new venue construction process that may not be present in discussion of environmental sustainability in the management of older, already open venues: architectural designers, politicians, and environmental activists are a few of those stakeholders. Overall, this motivation research could be summarized by stating that there is an abundance of research on what motivates a variety of sport stakeholders to adopt environmental sustainability. And, while there is little research on demotivators to environmental sustainability, it may be possible that part of what scares sport managers away from adopting environmental sustainability in their organization is that they are unsure of what environmental impacts their organization has, how those are measured, and then ultimately what could be done to mitigate those impacts while providing a benefit to their organization.

Another common area of interest within the literature is focused on organizational perspectives of environmental sustainability in sport: the history and evolution of environmental sustainability, how stakeholders influence decision-making on environmental sustainability, and how organizations respond to pressures related to environmental sustainability. For example, a number of studies have examined the role of environmental sustainability in the Olympic Movement (e.g., Chappelet, 2008; Gold & Gold, 2013; Lesjø, 2000; Ross & Leopkey, 2017; Samuel & Stubbs, 2012). Research from Cantelon and Letters (2000) used institutional theory as a framework for analyzing environmental policy by itself, while Pentifallo and VanWynsberge (2012) considered how institutional pressures caused isomorphism to occur amongst the environmental sustainability plans for Olympic Games' bids. Further research on the Olympic Games has used stakeholder theory to examine the role of stakeholders in motivating the adoption of environmental sustainability in the Olympic Games (e.g., Kearins & Pavlovich, 2002; Ross, Leopkey, and Mercado, 2018). Outside of the Olympic Games Pfahl (2010) examined the issues that a manager must consider when creating an internal sustainability team within a larger sport organization, which was furthered by Pfhal, Casper, Trendafilova, McCullough, and Nguyen (2015) who examined how sport organizations manage environmental sustainability by examining how university sustainability department and athletics departments collaborate to achieve environmental sustainability objectives. While this provides only a small sample of this organizational perspectives research, it is important to acknowledge its presence and contribution to a broader understanding of how environmental sustainability has been integrated into the sport industry. This research provides implications for how a better understanding of environmental inputs and outputs in PAVs could be utilized by those professionals in the industry.

The final sector of environmental sustainability in sport research worth examining concerns how the sport industry engages consumers on the topic. Studies have examined undergraduate students environmental values, beliefs, and norms (Capser & Pfhal, 2012), intercollegiate athletic fans perception of athletic department efforts (Casper, Pfhal, & McCullough, 2014), environmental sustainability initiatives on donor intentions (Walker, 2013), sport teams as promoters of pro-environmental behaviors (Inoue & Kent, 2012a, Inoue & Kent, 2012b), and recycling intentions of spectators (McCullough, 2013; McCullough & Cunningham, 2011). These studies are important for building the conceptual picture of the environmental inputs and outputs of a sport organization since spectators play a large role in the environmental impact of a sport event. Their activities can be managed or utilized to help mitigate some of the environmental impacts of a sport event. As it relates to the present study, consumer behaviors at a sport event will be important to consider as an understanding of the environmental inputs and outputs of a sport organization are examined. The travel to the event (e.g., gasoline use and emissions), the trash they generate while at the event, and the resources they consume while at the event (e.g., water in a bathroom) are all potential environmental inputs and outputs. However, it is important to note that while those impacts may relate to the sport organization or a sport event, that some might not apply to the operation of a PAV.

Overall, the aforementioned research in this section on motivations, organizational perspectives, and engaging consumers, along with the articles from Xie and Hayase (2007), Mallen, Stevens, Adams, and McRoberts (2010), VanWynsberge (2015), and Johnson and Ali (2018), may provide insight into some of the inputs and outputs that various sports face. In general, this addresses some of the gaps found from the Mallen et al (2011) and Mallen (2018) research on the lack of inputs and outputs. The more we know about how environment impacts sport and how sport impacts its environment, the better sport managers can accommodate environmental sustainability.

2.6 LIFE CYCLE ASSESSMENT

Before moving forward, it is important to review the theoretical framework through which the research question posed was examined. Life cycle assessment (LCA) is both a theory and a method of analysis, which is sometimes called "cradle to grave" or even "cradle to cradle" if a product is recycled or upcycled (McDonough & Brauntgart, 2002). More specifically, LCA is the analysis of particular product from its creation until its destruction. This approach to the comprehensive assessment of a product or service from its inception until its destruction is what differentiates LCA from other methods of analysis like the environmental impact assessment proposed by Welford and Gouldson (1993). Finnveden and colleagues (2009) consider LCA to be a comprehensive approach to examining the environmental impact of a product or service since. As an example of this perspective, a product would be examined from the raw materials used to create it, the life cycle of those raw materials, the manufacturing process, distribution, purchase, use, repair, and ultimate disposal or destruction. As such, LCA requires inventorying environmental inputs and outputs as a part of its overall assessment along with evaluating the impact of those inputs and outputs, as well as interpreting the results of the analysis (Finnveden et al, 2009). LCA may also be a system of management and embedded thinking within an organization that seeks to understand its full environmental impact. Overall, LCA is an approach to understanding the environmental impact of a product or service that is similar to a systems theory approach (Meadows, 2008).

Interest in LCA grew rapidly in the 1990s to the point that the International Organization for Standardization (ISO) in 2006 created an internationally recognized standards for the LCA method in ISO 14040 (ISO, 2006a) and ISO 14044 (ISO, 2006b). According to the standards set forth by the ISO, an LCA consists of four main phases: goal and scope definition, inventory analysis, impact assessment, and interpretation. In the first step, goal and scope, the context of the study is defined and the limitations and delimitations identified. As part of defining the goal and scope, the function unit is identified, the boundaries of the system are defined, assumptions and limitations are communicated, shared processes are allocated to a particular unit, and lastly impact categories are identified (ISO, 2006a; ISO, 2006b). In the case of the present study, the functional unit was the PAV, the system boundaries were only those environmental inputs and outputs which have a direct connection to the PAV, the limitation is that this study was not able to assess the PAV from the cradle to the grave but rather just in its operation (as PAV operations managers are not contributors to the design, construction, and demolition of the venue), and the impacts were environmental. The inventory step requires cataloguing the flow of materials and services in the system (ISO, 2006a; ISO, 2006b). In the case of a PAV, this would involve cataloguing the environmental inputs required for operation and the outputs created as a result of operation. The impact assessment step requires selecting the impacts measured, the indicators or measures of those impacts, sorting those indicators and impacts into related categories of information, and then ultimately measuring those impacts (ISO, 2006a; ISO, 2006b). With regard to the present study, this is the stage that would become possible through the results of understanding the environmental inputs and outputs and their measures for a PAV – part of the research question this study was focused upon. Lastly, the final step is interpretation and communication of the results of the LCA: identifying significant issues, evaluation of the study as a whole, and providing conclusions regarding the functional unit of concern (ISO, 2006a; ISO, 2006b). As was previously stated, this is a step that would be possible through the results of the present study. Given this understanding of LCA and its process, it is now possible to consider sport management research that has utilized LCA in its analysis.

LCA has been used before in sport management. For example, Dolf and Teehan (2015) used LCA in order to examine the environmental impact of spectator and team transportation to a sport event. However, this study only examines one specific life cycle unit of a sport organization: transportation. Another study from Costello, McGarvey, and Birisci (2017) examined the greenhouse gas life cycle with respect to waste mitigation at a college football game. This study also focuses on only one specific aspect of a sport event: waste. A full LCA of a sport or entertainment organization or a live event would need to look other life cycles beyond just transportation and waste, which might include all specific raw materials, goods, and services from cradle to grave. The use of LCA in the present research would be unique due to its further extension into the field of event management in general and first use in the context of public assembly venue operations. In the case of a PAV, its service is easier to conceptualize when compared to a specific good: the PAV takes inputs like raw materials, goods, and services; utilizes those inputs, and then ultimately disposes of them. More broadly, one would examine the PAV from the materials used in constructing it to the disposal of the waste created by the demolition of the PAV. However, such broad assessment of a PAV would be too difficult to measure in the short term and the present study is more focused on how the operation of the PAV impacts the environment of the community. Therefore, it was prudent to start by simply examining what types of inputs a PAV requires and what outputs they produce rather than attempting to examine a full life cycle of all goods and services a PAV utilizes. Therefore, for the present study's research question, LCA provides an appropriate framework for analysis into a cross section of the environmental impact of a PAV.

2.7 BEST-WORST SCALING AND MAXIMUM DIFFERENTIAL

When it comes to decision-making on in PAVs, managers will have a variety of metrics that they may utilize to guide them to their conclusions. In the context of environmental sustainability, there are a variety of environmental inputs and outputs that may be utilized to quantify the value of a particular environmental performance. However, not all of those inputs and outputs may be given equal priority by PAV managers. Certain environmental inputs (e.g., electricity used) and outputs (e.g., waste generated) may carry more weight for the decision-making process than others. In order to determine how PAV managers prioritize each input and output, a method was used that provides results that show the relative value between each. Best-worst scaling (BWS) and more specifically maximum differential (MaxDiff) were those methods and theories that were able to provide those results.

BWS serves two purposes: it is a method for collecting data as well as a theory for how choices are made between three or more items. First, consider BWS as a method of data collection. BWS is a type of discrete choice experiment first used by Jordan Louviere (Louviere, Flynn, & Marley, 2015). In BWS, participants are given a set of items and asked to select the best and the worst items from among the set. There are many ways to organize the items: a full list, several subsets of items, or even paired choices (Louviere et al, 2015). A more specific type of BWS, which is commonly confused with BWS as a whole, is known as maximum differential (MaxDiff). As clarification, MaxDiff is a type of BWS, but not all BWS is MaxDiff. In MaxDiff, participants are given a set of three or more items to consider from a larger list of items. Of that subset of items, participants are asked to select the best (i.e., highest ranked) item based on the experimental guidelines and then, from the remaining items, to select the worst item (i.e., lowest ranked) (Flynn & Marley, 2014). As an example, suppose that a participant had the choice between items A, B, C, or D. Based on the guidelines of the experiment, this participant may pick item A as the best. From there, the participant will have items B, C, and D remaining from which they must pick the worst. Participants are then asked to repeat this task and to select a new best and worst from a new subset of items. This newer subset of items may contain repeats of previous items or may be entirely new items. Thus, the new subset could be, but is not limited to: items C, E, F, and G or potentially items E, F, G, and H. The composition of all of the subsets as well as how many iterations of the task must be completed by participants are both determined by the design of the study (Flynn & Marley, 2014). The data from this experiment would then be analyzed based on the theoretical side of BWS.

From the example experiment above, the theory behind MaxDiff can be used to explain the decisions-made and the meaning of those decisions (Louviere et al, 2015). It was known that item A was the best of the example subset of items. Presume that item D is the worst. Based on that information alone, it can be determined that item A is therefore better than items B, C, and D. As well, it can be determined that item D is worse than items A, B, and C. Only one relationship between the items cannot be inferred based on this one best and worst selection: the relationship between items B and C (Louviere et al, 2015). It is for this reason that further iterations of the experiment are conducted which help to reveal those relationships between the various remaining items like items B and C as well as items D, E, F, G, and H. In MaxDiff, all of the possible pairs of items are eventually evaluated by the participant, whereas some BWS do not require all comparisons to be made (Louviere et al, 2015). Some suggest the 'rule of three' to ensure that items are listed an equal number of times over the repetition of several of the tasks, which means that an item should be shown to the participant three total times (Lopovetsky, Liakhovitski, & Conklin, 2015). Another popular method of ensuring that all of the items are compared an equal number of times in MaxDiff is the balanced incomplete block design (Colbourn & Dinitz, 1996). However, it is important to keep in mind that MaxDiff is only one type of BWS and that there are several different types of BWS.

It should be noted that it has been suggested that the best method of generating the items of interest to be utilized in discrete choice experiments and therefore BWS experiments is through qualitative data analysis and interpretation (Coast, Al-Janabi, Sutton, Horrocks, Vosper, Swancutt, & Flynn, 2012). Many studies that utilize discrete choice experiments have been known to poorly report how the items in question are generated.

Louviere, Flynn, and Marley have proposed three different types of BWS, which they call “cases” (Flynn, 2010). Case one, called the ‘object case,’ presents multiple items that may be unrelated (e.g., attitudinal statements, marketing messages, or images) and requires participants to choose a response from amongst those items (Flynn, 2010). In other words, participants are picking best and worst from amongst different items. This method avoids scale biases and requires that the items in question compete between each other which affects the participant’s response (e.g., biases that result when participants are only allowed to respond with Likert-type scales: comparing ratings between participants or all items being rated equally), which will be discussed further in the paragraph that follows. Case one studies usually use a balanced incomplete block design which require that every item appear the same number of times over the course of the experiment and that each item therefore competes with the other items and equal number of times (Louviere et al, 2015). Case two, called the ‘profile case,’ presents multiple, often related, choices within a singular profile (e.g., best logo for a sports team) and requires participants to respond with the best and worst choices from within that profile

(Flynn, 2010). The advantage of case two is that it is easier to interpret questions than a discrete choice experiment or the method described in case one. Case two studies typically use an orthogonal main effects plan in their design for how items appear (Louviere et al, 2015). The final case, known as case three or the 'multi-profile case' extends the discrete choice model to three or more profiles where participants select the best and worst profile overall rather than one object (Flynn, 2010). In other words, for case three, a participant would be selecting the best profile of items and the worst profile of items rather than simply one item from within a profile. With this understanding of BWS, it is important to consider its relative strengths and weaknesses as a method.

The steps and analysis involved in conducting a BWS study are important to review in order to build a complete understanding of this method. First, the items of interest must be identified so that participants have items to respond to during the experiment (Louviere et al, 2015). As was mentioned earlier, it has been suggested that qualitative methods of data collection are best for generating these items (Coast et al, 2012). One must then choose a statistical design (e.g., balanced incomplete block design or an orthogonal main effects) that is appropriate for the case of BWS to be utilized to ensure that participants are shown items for consideration in a manner that generates useful data (Louviere et al, 2015). The choice sets are then constructed and collect data from participants choosing the best and worst from amongst sets of items. While there is no set standard for sample size, it has been suggested that a minimum of three hundred responses is sufficient for BWS and that a minimum of two hundred responses per group is necessary if wanting to compare responses between sets of groups (e.g., indoor arenas versus outdoor stadiums) (Lipovetsky et al, 2015). BWS studies with few items have even been successfully completed with as few as 41, 73, and 136 responses (O'Reilly & Huybers, 2015). And, lastly the data must be analyzed and interpreted. The first step in this process is usually plot the choice frequencies. Scores reported often include utility scores, raw counts, and rank orders of items (Louviere et al, 2015). While it is easy to determine best and worst items based on those that receive that designation from participants, those items that remain in the middle are more difficult to interpret; however, there are statistical means of interpreting such data. Overall, the estimated utility parameters that yields the ranking and resultant data for interpretation about the items overall are typically determined based on a random utility model and more specifically a conditional logistic regression model that is based on the maximum differential assumption that best-worst scaling utilizes (Flynn & Marley, 2014). In other words, the random utility model determines the value of item A over item B by how often item A is chosen over item B over the course of the experiment. That frequency of choice is considered in generating the overall understanding of the utility placed on each item. Overall, the BWS method is not overly complex, but does require a careful examination of the data collected. Before moving out of the literature review and into methodology, the relative strengths and weakness of BWS will be examined.

BWS has a number of strengths compared to a more conventional method like using a Likert-type scale (i.e., strongly disagree to strongly agree). First, BWS is not prone to response bias and scale inequivalence where participants may fall into a pattern of response that is unrelated to the questions (Baumgartner & Steenkamp, 2001; Dolnicar & Gruen, 2007). The tendency to agree or to respond at the extremes of scales are examples of such that are avoided through the BWS method. This method also avoids the difference in interpretation of a particular rating from one participant to the next. Instead, BWS is based on a consistent response (i.e., the best and the worst) from an overall set of items. It is known that BWS measures typically outperform other rating methods in areas like differentiation of importance among scale points and predictive validity (Chrzan & Golovashkina, 2006; Hein, Jaeger, Carr, & Delahunty, 2008). Since strengths were considered, it is also important to discuss weaknesses for BWS. Due to the fact that questions ask for best and worst, it therefore requires collection of two sets of data, which can be difficult to relate and analyze without an understanding of how participants came to define their best or worst choices. As well, since this requires participants to state preferences, it does not show if their stated preferences are consistent with the choices participants would actually make in the real world (Louviere et al, 2015).

As a method, BWS was appropriate for use in the present study as it adequately addressed the research question posed. It was first used in a sport management setting by O'Reilly and Huybers (2015), which suggests that its use may still be very unique within the discipline. With this overall examination of the literature (i.e., sustainability, inputs and outputs, LCA, and BWS), it is now possible to move forward and review the methodology utilized to answer the research question posed by this study.

Table 2.1

SE-EPM Evaluation Operational Measures from Xie and Hayase (2007) as well as Mallen, Stevens, Adams, and McRoberts (2010)

Tracking Measures	Input Measures	Output Measures
Energy use	Oil use (kl)	General waste disposal (ton)
Environmental financial resource use	Gas use (m^3)	Industrial waste disposal (ton)
General wastes	Electricity use (kWh)	Carbon dioxide emission (CO_2 per ton)
Water drainage	Water use (m^3)	Sulphur dioxide emission (kg)
Air and water pollution	Raw material use	Nitrogen oxide (NO_x) emission (kg)
Greenhouse gases	Paper use (ton)	Biochemical oxygen demand (kg)
Compliance	Packaged material use (ton)	Chemical oxygen demand (kg)
	Chemical use (kg)	Water drainage (ton)
		Pollutant Release and Transfer Release (PRTR) chemicals released (kg)
		PRTR chemicals transferred (kg)

Table 2.2.

LEED Maintenance and Operation Certification Standards (USGBC, 2018)

Category	Specific Impacts Evaluated
Location and Transportation	Alternative transportation
Sustainable Sites	Site management policy, site development (protection or restoration of habitat), rainwater management, heat island reduction, light pollution reduction, site management, site improvement plan, joint use of facilities
Water Efficiency	Indoor water use reduction, building-level water metering, outdoor water use reduction, cooling tower water use, water metering
Energy and Atmosphere	Energy efficiency best management practices, minimum energy performance, building-level energy metering, fundamental refrigerant management, existing building commissioning, ongoing commissioning, optimize energy performance, advanced energy metering, demand response, renewable energy and carbon offsets, enhanced refrigerant management
Materials and Resources	Ongoing purchasing and waste policy, facility maintenance and renovation policy, purchasing (ongoing, lamps, and facility maintenance and renovation), solid waste management (ongoing and facility maintenance and renovation)
Indoor Environmental Quality	Minimum indoor air quality performance, environmental tobacco smoke control, green cleaning policy, indoor air quality management program, enhanced indoor air quality strategies, thermal comfort, interior lighting, daylight and quality views, green cleaning (custodial effectiveness assessment and products and materials), integrated pest management, occupant comfort survey
Innovation	Innovation, LEED accredited professional
Regional Priority	Regional priority

CHAPTER 3

METHODOLOGY

In light of the specific research question posed and the literature reviewed thus far, this section presents the methodology utilized to answer the research question posed at the beginning of this study: of the environmental inputs and outputs in sport and entertainment live event management, which do PAV managers prioritize when making decisions on environmental sustainability within their building? The PAV was chosen as the subject of this study due to their function as venues for sport and entertainment live events and for their unique operation in comparison to other traditional buildings. For example, a house or an office may function on a regular schedule and can expect to operate according to that schedule daily, whereas a PAV is fully functioning for only a few days of the week at a time and then lies mostly dormant for the days in between. A stadium that holds 80,000 fans in particular is not filled with 80,000 individuals every day nor does it have to account for the environmental impact and operations necessary to accommodate 80,000 people daily. Live events also occur during off peak hours for normal business (i.e., an event in an arena might occur at night when other business are closed for the day). As such, the environmental impact of a PAV will be different in comparison to other buildings due to the unique nature of their use. Additionally, it should be noted that the present study considers the whole operation of a PAV in general (on the day of events and on days off from events). With this in mind, it is possible to review the specific methodology utilized for addressing the purpose of the present research.

3.1 PANEL OF EXPERTS REVIEW OF PROPOSED ITEMS

Starting with the profile of environmental inputs and outputs derived from the review of literature, this study planned to use a best-worst scaling (BWS) method to allow participants to rank various environmental inputs and outputs they prioritize within the operation of a PAV. However, those items needed to be reviewed by a panel of experts prior to their use in a survey to ensure their accuracy and comprehensiveness as descriptors of the environmental impact of the operation of a PAV. This review by a panel of experts ensures validity of the items utilized as the participants in the expert panel are active and knowledgeable participants in the PAV industry as well as experts in environmental sustainability (Zikmund, Babin, Carr, & Griffin, 2012). Beginning with the eighteen inputs and outputs listed in the SE-EPM model along with the inclusion of the input of food consumption and output of food disposed (see Table 3.1) these items were submitted to a panel of experts which included two venue managers, a faculty member in sport and entertainment management, as well as a faculty member in environmental science. Feedback from these experts included the elimination of several items due to their lack of attention from venue managers, the merging of multiple items into one or two items that better capture the whole impact of the group, merging the inputs and outputs groups into one larger overall impact profile, as well as the addition of an item not previously seen. In particular, raw material use, paper use, packaged material use, biochemical oxygen demand, chemical oxygen demand, Pollutant Release and Transfer Release (PRTR) chemicals released, and PRTR chemicals transferred were eliminated from the items list as they are not actively tracked or of concern to the venue managers or the venue management industry. Water use and water drainage were merged into one item. General waste disposal and industrial waste disposal were merged into one item. And, carbon dioxide emissions, sulphur dioxide emissions, and nitrogen oxide emissions were also merged into one item. One item was added based on recommendations from three of the experts: use of disposable items in venues such as plastic silverware, paper towels, drink cups, and other single-use items since these items are a potential decision point for PAV managers. Ultimately, the final list of nine items utilized in this study to represent the profile of the manager-perceived environmental inputs and outputs of a PAV consisted of: oil use, gas use, electricity use, water use and drainage, chemical use, food consumption and disposal, waste disposal, emissions created, and the use of disposable items. Since these items were reviewed by the panel of experts, they were a sufficient representation of the environmental profile of the PAV since they are representative of the how the industry evaluates itself with regard to its environmental impact (Zikmund et al, 2012). Additionally, this new list of items was in accordance with the environmental impacts uncovered via the literature review from PAV- and environmental sustainability-focused organizations such as the GSA, IAVM, NRDC, and USGBC. With this new list of items, the survey and BWS method, sample, as well as the analysis may be reviewed.

3.2 INSTRUMENT AND DATA COLLECTION PROCEDURE

An online survey that utilizes a BWS method to measure the priority PAV managers place on the perceived environmental inputs and outputs within their building was developed using Qualtrics software. For this BWS survey, participants were given a set of items to consider. The number of items shown in each set was determined based on the number of items being compared as a whole per the requirements of the balanced incomplete block design since this was a Case One BWS analysis (Colbourn & Dinitz, 1996). Participants were asked to select the best (i.e., highest ranked or highest priority) item and then, from the remaining two items, to select the worst item (i.e., lowest ranked or lowest priority) (Flynn & Marley, 2014). PAV managers completing the survey were allowed to decide what they perceived to be the highest priority input or outputs according to their own decision-making process on PAV operation and sustainability. Thus, the interpretation of highest or lowest priority is subjective to the participant, which is part of the process of BWS. This provides data on which, of the set of items in question, is the best and which is the worst.

In order to collect data on the priority relationship between the remaining items from the whole set of items, participants were then asked to select a new best and worst from a new list of items, which may have contained repeats of previous items or may have been entirely new items. Order bias in the items was combatted by distributing the items evenly throughout each new set of items according to the requirements of the balanced incomplete block design, which means that the number of iterations of this task was determined by the total number of items that participants must respond to (Colbourn & Dinitz, 1996; Flynn & Marley, 2014). The rule of threes (that each item must appear at least three times throughout the repetition of the tasks) and balanced incomplete block design were utilized to ensure that all of the items would be given an equal number of opportunities within each set of items (Colbourn & Dinitz, 1996; Lipovetsky et al, 2015). The R package “cossdes” and the specific command “find.BIB” was used to generate the sets participants will see based on the previously mentioned principles. The generated set was checked with the “isGYD” command to ensure that the balanced incomplete block design standards were met. Since there were a total of nine items to compare, find.BIB suggested an BWS design of twelve blocks of three items, which per the isGYD check satisfied the requirements of the balanced incomplete block design from Colbourn and Dinitz (1996). Each item was shown a total of four times which satisfied the rule of threes minimum and that each item was evaluated and equal number of times (Colbourn & Dinitz, 1996; Lipovetsky et al, 2015). This BWS design was employed for this study. An example of one set of BWS items that participants saw in the survey has been provided in Figure 3.1 at the end of this chapter.

BWS has a number of strengths compared to a more conventional method like using a Likert-type scale (i.e., strongly disagree to strongly agree). First, BWS is not prone to response bias and scale inequivalence where participants may fall into a pattern of response that is unrelated to the questions (Baumgartner & Steenkamp, 2001; Dolnicar & Gruen, 2007). The tendency to agree or to respond at the extremes of scales are examples of such that are avoided through the BWS method. This method also avoids the difference in interpretation of a particular rating from one participant to the next. Instead, BWS is based on a consistent response (i.e., the best and the worst) from an overall set of items. It is known that BWS measures typically outperform other rating methods in areas like differentiation of importance among scale points and predictive validity (Chrzan & Golovashkina, 2006; Hein, Jaeger, Carr, & Delahunty, 2008).

In addition to the BWS portion of the survey, participants were asked to identify how they defined the valuation of best (highest priority) or worst (lowest priority) from a selection of motivations to go green factors from Walker, Salaga, & Mercado's research (2016) (e.g., financial impact, environmental impact, regulatory impact, and other factors). Participants were also asked both for their overall impressions regarding the priority of each item on a traditional Likert-type scale and to provide a yes or no answer regarding if they had a program in place to address each of those nine environmental impacts as a backup to the BWS data.

Other data collected included information on PAV where the participant is currently working to supplement the BWS responses. This information was anonymous as none would identify the individual participating in the survey. However, this information did provide other points of reference that helps to give context and would have been important for drawing comparisons between groups within the larger sample of PAV managers. Such information to be collected is based upon previous research into PAVs by the IAVM (c.f., IAVM, 2014). As such, the questions to be included as well as the responses provided have been determined by the IAVM which represents the PAV industry itself. Therefore, these responses are developed by industry personnel about the industry itself and these IAVM members will understand the potential responses provided to them. Such questions and the possible responses are listed below and are pulled from the an official IAVM (2014) sustainability report. Responses with definitions drawn from other sources are noted accordingly. With all of these questions, participants had the choice to not respond if desired:

- Type of PAV: arena/civic center, stadium, theatre/performing arts center, convention center/exhibit hall, fairgrounds/amphitheater, or other

- Size of the PAV: small, medium, large (see Table 3.2 for description of these responses)
- Age (in years) of their PAV: open response
- Market Tier: primary, secondary, and tertiary
- Region of the United States: Region 1, Region 2, Region 3, Region 4, Region 5, Region 6, Region 7, or Region IAVM-VMA Asia/Pacific (IAVM, 2017c) (see Figure 3.2 for a map of these regions)
- Venue is: University-based or non-university-based
- Ownership: public owner (government/authority) or not public owner (private/non-profit/other)
- Management: public management (government/authority) or not public management (management company/non-profit/other)
- Does your venue currently employ environmentally sustainable practices: yes or no
- Does your venue currently track or assess environmental sustainability: yes or no
- How important is it that your venue be environmentally sustainable: very unimportant, somewhat unimportant, neutral, somewhat important, very important
- Which of the following environmental sustainability certifications does your venue have: LEED, Energy Star, City, State, ISO 14001, Green Globes, or other
- Where do you get information on environmentally sustainable practices within the PAV industry: industry publications, industry conferences, non-profit organizations, other, and “I do not get information on environmental sustainability”

All of these questions were placed at the end of the survey after the completion of the BWS tasks.

In order to ensure the accuracy of the survey, and respect the time of venue managers (who as a profession do not spend much time sitting behind a desk), the survey was kept short to ensure that participants would not become fatigued while responding. In total, the survey took participants on average five minutes to complete. It is believed that because the task selection is simple and quick and because the survey was short, that fatigue did not impact participants' responses. Participants were also notified of their progress through the survey as they responded to questions.

Before distributing the survey to the IAVM and other PAV professionals who would serve as potential respondents, it was reviewed by a panel of experts to ensure the validity of the BWS and survey instrument. The panel of experts included faculty from the College of Hospitality, Retail, and Sport Management. These experts were asked to review the survey instrument and provide feedback on its design and validity. Modifications were made to the survey as necessary based on the feedback from the panel of experts. Additionally, an early version of this survey was pilot tested on students in the College of Hospitality, Retail, and Sport Management to ensure that the data collected would be usable and that the appropriate analysis could take place. The survey that resulted from this review by the panel of experts and the pilot testing on students was then distributed to potential respondents which will be addressed in the section that follows. The full survey utilized has also been provided in Appendix A for your consideration.

3.3 PARTICIPANTS AND SAMPLE SIZE

According to Lipovetsky and colleagues (2015) a minimum of three hundred respondents is a sufficient sample size to run a BWS and report results for the whole sample with 95% confidence. There is no need to compare the sample size to the total population. Analysis that breaks apart the sample to make comparisons between types of PAVs or other comparable groups, requires a minimum of two hundred respondents per group to achieve that 95% level of confidence (Lipovetsky et al, 2015). Some studies have gathered a minimum of four hundred total responses (c.f., Auger, Devinney, & Louviere, 2007), while others have successfully run BWS with nine items and comparing groups with sample sizes of those groups as low as 73, 136, and 41 (c.f., O'Reilly & Huybers, 2015). Overall, there is no consensus on an appropriate sample size for BWS.

For the present study, in order to determine how PAV managers prioritize environmental inputs and outputs when making decisions related to environmental sustainability in PAV operations, an online BWS survey was designed and distributed to PAV managers. PAV managers are a credible authority on PAV operations and were the most desirable participants to answer questions on operational knowledge, decision-making, and environmental sustainability in PAVs (Miles, Huberman, & Saldaña, 2014). In order to reach this targeted population, the primary investigator partnered with the International Association of Venue Managers (IAVM) to distribute the survey. The membership of IAVM includes those professionals working in the public assembly venue industry (IAVM, 2017b). Therefore, distribution to IAVM membership will ensure that those responsible for operations within venues are the ones who will receive and respond to the survey. The IAVM distributed the survey link to approximately 300 students and faculty of their Venue Management School who are all professional PAV managers. Additionally, the survey link was posted to an online message board accessible to all IAVM members. Lastly, the survey link was emailed directly to approximately 100 PAVs that are members of the Green Sport Alliance, which offers information and the best practices on environmental sustainability in sport to sport industry practitioners (GSA, 2018a).

In total, it is estimated that the survey was distributed to over 1,000 PAV managers. These potential participants were given four weeks to complete the survey and were given a reminder to complete the survey approximately halfway through those four weeks. In total 258 surveys were returned with 222 of those surveys suitable for use in the data analysis for a response rate of approximately 22.2 percent. These 222 surveys still offered enough statistical power to accurately analyze with BWS methods given that there were only nine total items for respondents to consider. Thus, this data does accurately reflect the priority placed on each environmental input and output by the whole population of PAV managers (Howell, 2014). It should be noted that PAV managers are a difficult population to have complete surveys as they do not typically spend a work day at their desk completing paperwork or even checking emails. They are an active profession that are constantly in motion out of the office. Therefore, having 222 PAV managers respond to the survey is quite remarkable within the context of this industry. Those 222 returned surveys were then exported from Qualtrics for use in the analysis phase.

3.4 DATA ANALYSIS

Upon completion of the data collection timeline, data from the returned surveys were exported from Qualtrics into a Comma Separated Values (CSV) file to be examined and cleaned prior to analysis. Analysis on the supplemental data was run in the Statistical Package for the Social Sciences (SPSS), which included running frequencies on the responses which provided background information on the PAVs represented in the sample collected.

The data from the BWS portion of the survey underwent a more rigorous analysis which followed the prescribed methods from Flynn and Marley (2014), Louviere, Lings, Islam, Gudergan, and Flynn (2013), Louviere, Flynn, and Marley (2015), as well as Mühlbacher, Kaczynski, Zweifel, and Johnson (2016). The first step of analysis for this portion of the data included calculating BWS scores by hand from counts analysis of the data. This was followed by uploading the BWS data in to R statistical analysis software and utilized the following R packages to complete the analysis: BiasedUrn, foreign, and mlogit. From here, the counts analysis was replicated in R in order to confirm the earlier counts analysis by hand. Further analyses run in R on the BWS data included: individual-level counts analysis in order to create an implied ranking of the items for each respondent, an aggregate-level logistic regression analysis, an individual-level logistic regression analysis in order to create an implied ranking for each respondent, as well as an aggregate level rank-ordered logistical regression model that accounted for ties in the items' rankings (Flynn & Marley, 2014; Louviere et al, 2013). The results of these analyses as well as individual steps taken will be discussed in more detail in the chapter which follows.

There was insufficient data to accurately run the analysis on smaller groups within the data (e.g., comparing responses from the different types of venues or different sizes of venues), thus this step was not undertaken. However, comparisons were drawn between the various models considered to ultimately provide a summation of the relative priority levels of the all of the items. These results were compared with the literature on the subject and provided a greater profile of the environmental impacts of a PAV as well as how PAV managers prioritize the various environmental impacts of their buildings. From here, the results of the data analysis portion of the study may now be reported.

Table 3.1

Environmental Input and Output Items Reviewed by the Panel of Experts

Input Measures	Output Measures
Oil use (kl)	General waste disposal (ton)
Gas use (m^3)	Industrial waste disposal (ton)
Electricity use (kWh)	Carbon dioxide emission (CO_2 per ton)
Water use (m^3)	Sulphur dioxide emission (kg)
Raw material use	Nitrogen oxide (NO_x) emission (kg)
Paper use (ton)	Biochemical oxygen demand (kg)
Packaged material use (ton)	Chemical oxygen demand (kg)
Chemical use (kg)	Water drainage (ton)
Food consumption (lbs)	Pollutant Release and Transfer Release (PRTR) chemicals released (kg)
	PRTR chemicals transferred (kg)
	Food disposal (lbs)

Table 3.2

IAVM PAV Size Standards (IAVM, 2014)

	Size of Venue (seating capacity; square feet for convention)		
Venue Type	Large	Medium	Small
Arena/Civic Center	Over 12,000	7,501 – 12,000	Up to 7,500
Stadium	Over 35,000	15,001 – 35,000	Up to 15,000
Theatre/Performing Arts Center	Over 2,500	1,501 – 2,500	Up to 1,500
Convention Center	Over 500,000	100,001 – 500,000	Up to 100,000

Highest Priority	Environmental Impact	Lowest Priority
	Electricity	
	Chemicals	
	Disposables	

Figure 3.1. Sample BWS set of items.

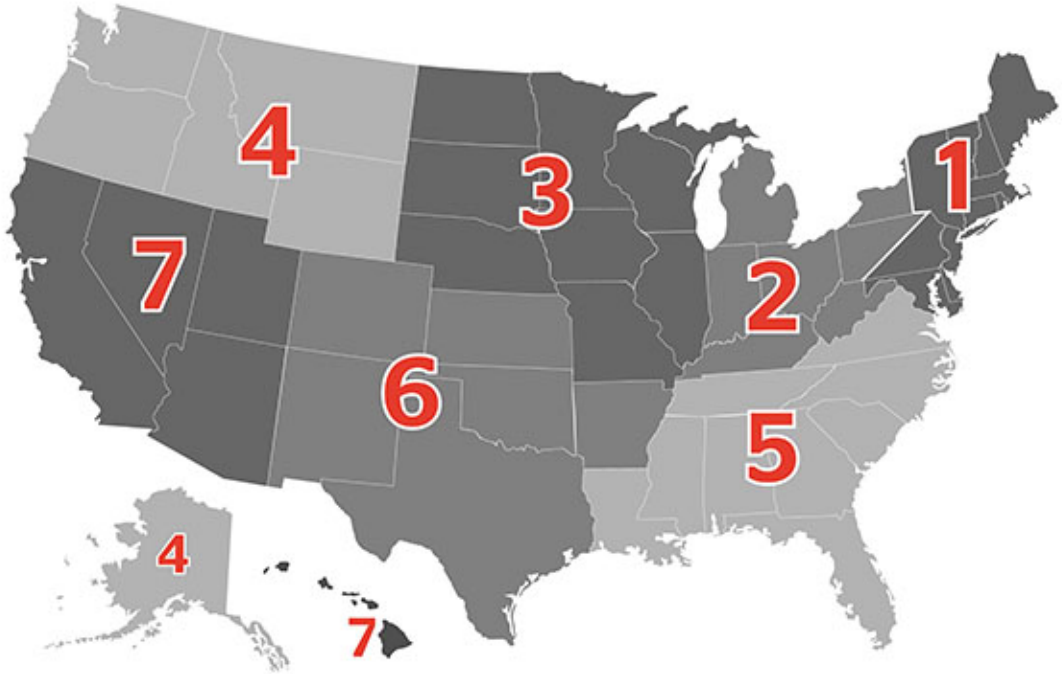

Figure 3.2. Map of IAVM regions within the United States (IAVM, 2017c).

CHAPTER 4

RESULTS

As mentioned in the previous chapter on methodology, raw data from the returned surveys were exported from Qualtrics and cleaned prior to its use in analysis. It was during this stage that the 258 returned were narrowed down to 222 usable surveys. Responses were discarded for being incomplete or for having skipped some of the BWS questions as proper analysis requires each respondent to fully complete the BWS portion of the survey. It should be noted that some survey responses were returned with the BWS portion completed but the supplemental data left blank. These surveys were retained for use in the BWS portion of the analysis but were discarded for the supplemental data analysis. Data from the survey came back with full text responses from each participant, which required that each response be recoded into a usable data for the analysis.

4.1 SAMPLE AND SUPPLEMENTAL RESULTS

This section will summarize the supplemental data collected about the venues represented in the sample. The supplemental data was uploaded to SPSS where frequencies and other descriptive statistics were run to provide some context into what types of PAVs responded to the survey.

A total of 206 respondents indicated what type of venue they represented in the survey. The three largest represented venue types included arenas and civic centers (28.6% of the sample), convention centers and exhibit halls (27.7%), as well as theatres and performing arts centers (26.2 percent of the sample). Frequency counts and percentages for all venue types are summarized in Table 4.1. Of those venues, most were large-sized PAVs (44.6 percent) with the next highest size representation being medium-sized PAVs (32.6 percent). These frequencies are summarized in Table 4.2. Lastly, the ages in years of the PAV were asked. The mean age of the PAV was 33.83 years with the median age being 32.00 years old. The standard deviation of the ages was approximately 23.73 years old. A histogram of the PAV ages represented in the sample is found in Figure 4.1 and shows that most of the PAVs in the sample were under 60 years old. Overall, these frequencies show that there is a diverse collection of PAVs represented in the sample collected with all types being accounted for, all sizes being represented, and a wide array of ages present.

Other data about the PAVs represented in the sample included market size, region, university-base, type of ownership, type of operator, whether they use environmentally sustainable practices, and whether they track environmental performance. All of this data is summarized in Table 4.3. Regarding the market sizes, most of the PAVs represented in the sample fit within the primary (48.8 percent of the sample) and secondary market (38.9 percent) sizes. These primary markets represent major cities like New York City or Los Angeles, while secondary markets include cities like Columbia, South Carolina. The three largest IAVM regions represented included Region Five (22.5 percent), and Regions Six and Seven (both with 15.0 percent). Region Five represents the Southeastern region of the United States while Region Six and Seven account for the central and western half of the Southern United States. This also demonstrates a diverse collection of PAVs present in the sample with every single IAVM region being represented along with each of the three market sizes. With respect to a

PAV being based at a university, 83.9 percent of the sample was not university based, while 16.1 percent were based within a university. The majority of PAVs in the sample (72.0 percent) were publicly-owned as opposed to privately-owned while the majority (59.4 percent) were operated by a private organization. Lastly, a large majority (78.8 percent) of the PAVs in the sample had employed some form of environmentally sustainable practices within the operation of their venue, but a much smaller portion of the sample (54.2 percent) were actively tracking their environmental performance of their operations. This shows that the survey did reach some venues with are currently employing environmentally sustainable practices while also reaching those that have not made the move to adopt environmentally sustainable practices yet. It is important to have both of those voices (those that are green and those that are not green) represented in the data.

Respondents were also asked if they had an environmental sustainability program in place to address each of the various environmental impact items which populated the BWS portion of the survey. Having a program to address those environmental impacts fluctuated greatly depending upon the particular environmental impact item in question. Most PAVs did not have a program in place to address use of oil (67.3 percent of the sample), use of gas (61.4 percent), or creation of emissions (63.9 percent). However, with respect to the consumption of electricity (74.8 percent), consumption and disposal of water (61.3), consumption and waste of food (82.8 percent), management of waste (82.8), and use of disposable products (74.5 percent) most of the PAVs sampled did have a program in place to address these environmental impacts. Use and disposal of chemical products was an even split at 50 percent. This data is summarized in Table 4.4. This again strengthens the idea that there are venues within this sample that have completely adopted environmentally sustainability as part of their operation while others have not been able to or not been able to achieve the level of success that others have. Since this sample was meant to represent all PAVs, it is important to have both those that are environmentally inclined and those that are not included.

In addition to this data, respondents were asked to indicate if their PAV has any environmental sustainability certifications and, if they do, which certifications do they have. Overall, 44.1 percent of the PAVs sampled had some form of environmental sustainability certification while the other 55.9 percent did not have any certifications. Some of the PAVs sampled had more than one environmental sustainability certification. However, of those certified PAVs most had a LEED certification (41.2 percent of the sample), city certification (22.5 percent), state certification (15.0 percent), or EnergyStar certification (13.8 percent). These results are summarized in Table 4.5. This provides further support to the notion that the sample of PAVs was diverse and included those that are already highly engaged with environmental sustainability as well as those that are not.

On the topic of information on environmentally sustainability practices in PAVs, respondents were asked where they receive such information. Of those that responded to this question. 78.9 percent are able to access information on environmental sustainability while the other 21.1 are not able to get such information. The majority of respondents received their information on environmental sustainability within PAVs from industry sources like publications (35.2 percent) and conferences (40.1 percent). These findings are summarized in Table 4.6. There were some interesting responses in the other category, which included: regulations, colleagues at other PAVs, sustainability committees from within the organization, and consultants. Overall, it does appear that most PAVs are receiving their information on the subject from within the industry itself.

Lastly, respondents were asked to provide their overall impressions on the priority of environmental sustainability within their PAV. Regarding the first question, respondents were simply asked to give their overall evaluation of the importance of environmental sustainability in PAVs on a 5-point likert-type scale. Full data from responses to this question are provided in Table 4.7. However, it should be noted that the vast majority (84.7 percent) of respondents placed their overall priority of environmental sustainability in one of the top two highest priority responses. Thus, overall this sample believed that environmental sustainability was important even if their specific PAV may not have been the most environmentally sustainable. And, with all of this information in mind regarding the PAVs represented in the sample, the BWS analysis may now be presented, which fully addresses the primary research question posed by this study.

4.2 BEST-WORST SCALING RESULTS

Before jumping into the BWS data, it is first important to understand how it is that respondents were defining "priority" in their responses. Once respondents had completed the BWS exercise, they were asked how they defined "highest priority" and "lowest priority" when evaluating the various manager-perceived environmental impact items as they relate to the operation of their PAVs. Table 4.8 summarizes the responses to this question. The two largest definitions of priority were defining priority as it relates to the environmental impact of the items (47.2 percent of the sample) and defining priority as it relates to the financial impact of the items (27.4 percent). Other responses included defining priority by the image of those items (8.0 percent), regulatory impact of those items (4.2 percent), stakeholder evaluation of the priority of those items (6.1 percent), and competitive priorities of the PAV (3.8 percent), but each of these responses were quite small compared to the priority definitions of environment and financial impact. This is important to understand moving forward with the data as it provides some evidence as to what the BWS rankings mean for the PAVs and their operation.

From this point onward in the data analysis process, the BWS data analysis followed prescribed methods from Flynn and Marley (2014), Louviere, Lings, Islam, Gudergan, and Flynn (2013), Louviere, Flynn, and Marley (2015), as well as Mühlbacher, Kaczynski, Zweifel, and Johnson (2016). Similar to the supplemental data, the BWS data was returned with full-text responses that had to be recoded into data suitable for use in the BWS analysis. For example, in a BWS set of items, data was returned with the highest priority item being listed as "highest priority," the lowest priority item being listed as "lowest priority," and the non-selected item being left blank. These were recoded into numerical values in accordance with the proper BWS analysis procedure (Flynn & Marley, 2014; Louviere et al, 2015). "Highest priority" was recoded to '"1," "lowest priority" was recoded to "-1," and the non-selected choice was given the code of "0" to indicate that it was shown but not selected.

Analysis of the BWS data began without uploading the data into any statistical software as the most basic analysis for BWS can be completed through basic counts of responses. The data was organized so that every response for every set of items was stacked upon the others while showing every single item in the data set. Thus, all nine items are visible, with the highest priority, lowest priority, and non-selected cells holding their respective codes and the other cells not shown in that set left blank. From here, simple BWS scores were calculated by adding the responses straight down the entire data sheet. Each individual item score per respondent was bound by the real value of the number of times each item was shown in the experimental sets (Flynn & Marley, 2014). Thus, for this study each item would therefore have a score between -4 and +4 for that individual. These scores were then added amongst all of the participants. In other words, the total number of lowest priority counts were subtracted from the total number of highest priority counts across the dataset to give a basic BWS score for each item which were bound by -888 and +888 (the -4 and +4 individual scores for the whole 222 response dataset). The implied ranks of the items are then based on the total scores with the highest ranked items having the highest scores and the lowest ranked items having the lowest scores.

Results from this hand count of the BWS scores may be found summarized in Table 4.9 and in Figure 4.2. The implied ranking of the items from best to worst is as follows: waste (466 BWS hand count score), electricity (320), disposables (281), water (162), food (-102), emissions (-219), gas (-227), chemicals (-248), and lastly oil (-418). These results could be interpreted to mean that respondents felt that the highest priority manager-perceived PAV operational environmental impacts were the PAV's ability to handle wastes, consumptions of electricity, and use of one-time use or disposable items. At the other end of the spectrum, their lowest priority manager-perceived PAV operational environmental impacts were the consumption of gas, use and disposal of chemical products, and consumption of oil products. It should be noted that these rankings do not imply that waste management is necessarily a top priority for these PAV managers, nor that oil use is necessarily not a priority at all. These results simply indicate that the following relationship chain of environmental priorities for PAV managers could be inferred from this data from highest priority to lowest priority: waste, electricity, disposables, water, food, emissions, gas, chemicals, and oils. The higher on the list, the likely the item is to be a priority over the others. As well, the lower on the list, the less likely the item is to be a priority over the others. This interpretation of the BWS data will remain true for the rest of the analysis and results.

While this is a first step of BWS analysis, it is not complete. A more rigorous analysis procedure was required to accurately capture how PAV managers prioritize the various environmental impacts of the operation of their buildings. The previously stacked data utilized to calculate the basic BWS scores was uploaded into R statistical analysis software. The packages “BiasedUrn,” “foreign,” and “mlogit” were utilized to accomplish of the rest of the data analysis within R. The first step was a counts analysis which confirmed the findings from the earlier basic BWS scores calculated by hand. The results of this first step of R analysis may be found in Table 4.10, but provide the exact same implied ranking as the count by hand from before with waste ranking the highest and oil ranking the lowest.

Moving forward with the BWS analysis process, while these first two steps have been at the aggregate-level, the next step undertaken examined the data from an individual level. As such, a counts analysis was completed for each individual respondent to create an implied BWS ranking of the items for each respondent. Then, the rankings of each respondent were aggregated into Table 4.11 which shows each item along with the proportion of respondents that have each item ranked at the level indicated. This stage shows that electricity had the highest number of top priority rankings from respondents (approximately 30.2 percent of the individual respondents) with waste having the second highest number of top priority rankings (27.0 percent). However, when looking at both the top and second highest priority rankings, one can see that waste has more top two rankings (48.6 percent) than electricity (44.6 percent). This implies that more individuals ranked electricity at the highest priority, but more individuals thought that waste was at least a top two priority. At the other end of the ranking spectrum, fewer individuals had waste ranked at the lowest (0.9 percent) than electricity (4.1 percent). Amongst the other items, oil had both the highest proportion of lowest rankings (23.9 percent) as well as the lowest proportion of highest rankings (0.9 percent). Food was also an interesting item as it had the second highest lowest rankings (18.5), but also had the highest number of middle rankings (19.4 percent at ranking 5). While these results are interesting and provide some depth to the analysis, an aggregate ranking of these proportions was possible.

Thus, the aggregate-level ranking of the items was created based upon the individual-level implied rankings (Louviere et al, 2013). This differs from the previous counts analyses in that the implied BWS ranking of the items is based on each individual's implied ranking rather than based on the aggregate BWS counts. The results of this analysis may be found in Table 4.12. This ranking is similar to the implied rankings from the hand count BWS scores; however, in this ranking gas has moved up the ranking to the sixth highest priority and emissions has moved down to the seventh highest priority. All other rankings remained the same with waste, electricity, and disposables placing as the top three highest priorities while emissions, chemicals, and oil finished as the bottom three lowest priorities.

Following this individual-level ranking procedure, the data from R had to be recoded to allow for its use in analysis with a conditional logistic regression model, which is one of the preferred methods of analysis of BWS data (Flynn & Marley, 2014) and should be regarded as the analysis of choice for this study. The data had to be altered to ultimately add a column of data called "choice" which was coded with a binary "1" for yes or "0" for no. This is necessary to trick the analysis into working with the requirements and assumptions of logistic regression analysis (Louviere et al, 2015). One flaw in this analysis is that it violates the assumption that the responses are independent of each other since the responses by participants are impacted by the items available to select in each set. Therefore, the parameter estimates may contain bias, which is why other methods of analysis are considered in this results chapter.

As part of the data transformation required to trick the analysis, each individual set of three options was split into six rows of data with each item represented by a column. In each row, a "1" or "-1" would be shown in only one of the columns to indicate that this item was available to be chosen as a potential "highest priority" or "lowest priority," respectively. All of the eight other items had zeros. Of those six rows of data, two would have a "1" under "choice" to indicate that the item shown was selected as either the highest (in rows with a "1) or lowest (in rows with a "-1") priority item. The other four rows of data had a "0" in the choice column to indicate that they were not selected. Figure 4.3 provides an image of this data for your consideration. From here, the nine manager-perceived environmental impact items were regressed as independent variables onto "choice" as the dependent variable with a conditional logistic regression model. Logistic regression is preferred since the dependent variable is binary

(Flynn & Marley, 2014). The estimated parameters are compared to create the ranking of items. These parameters as well as their p-values are reported in Table 4.13.

Results from the logistic regression analysis were encouraging, with all item parameter estimates being returned with an extreme level of significance ($p < 0.000$). The implied rankings of the items are based upon their parameter estimates from the conditional logistic regression analysis. Therefore, for this analysis, the implied ranking (along with parameter estimates) is as follows from best to worst: waste (3.142), electricity (2.142), disposables (1.899), water (1.095), food (-0.716), emissions (-1.480), gas (-1.541), chemicals (-1.682), and lastly oil (-2.824). Under the normal circumstances of regression, it would be possible to infer a relationship amongst the items based upon the parameter estimates; however, for in the case of BWS analysis, the only relationship that can be inferred is the implied ranking of the items based upon those parameter estimates with the higher value estimates being ranked higher overall. Therefore, one should not interpret the parameter estimates to mean that there is any quantifiable relationship between waste and electricity, but rather that waste is simply a higher overall ranking than electricity per this analysis. These overall rankings are the same as those found via the hand count of the BWS scores as well as the initial R counts analysis. And, while this analysis is considered to be the analysis of choice for this study, two others were run in order to provide alterative perspectives on the potential ranking of the level of priority of the manager-perceived environmental inputs and outputs of a PAV from the perspective of these PAV managers.

Two more analysis were considered in order to provide alternative perspectives on the data which followed procedures described by Flynn and Marley (2014) as well as

Louviere, Flynn, and Marley (2015). Neither of these analyses violated the independence response assumption previously discussed with the aggregate logistic regression analysis – although they do rely on assessing the relative importance of each item rather than an absolute measure of their importance.

The first was to run the logistic regression for each respondent. In this approach, a conditional logistic regression analysis was run for each individual respondent, then implied rankings were generated based off those regression results for each individual respondent and ultimately aggregated. The first step in this process is to create those aggregate implied rankings for each individual respondent. This was accomplished through an inverse logistic transformation, which took the parameter estimates from the logistic regressions and converted them into probabilities. The results of this process were identical to those found in Table 4.11, which is an indication of the strength of the experimental design utilized as the regression analysis does take the experimental design into account during the analysis while the counts process does not. Finally, the average probabilities and their ranks were calculated using this data. Results from this portion of the analysis may be found in Table 4.14. Findings from this analysis for the five highest ranked items (in order of priority: waste, electricity, disposables, water, and food) as well as the lowest ranked item (oil) are similar to those found from the counts analyses as well as the previous logistic regression analysis. However, there is a shift in the rankings of items from spots six through eight. In this individual-level regression analysis, emissions rose to sixth highest ranked with a probability score of 0.087, as did chemicals (0.080), and gas ultimately fell to eighth highest ranked (0.080). Thus, the final ranking of the items from this analysis is as follows from highest ranked to lowest ranked: waste (implied rank: 1), electricity (2), disposables (3), water (4), food (5), emissions (6), chemicals (7), gas (8), and oil (9). This shows the strength of those top five items as being ranked the highest priorities, but shows some inconsistency at the individual-level for how respondents ranked these other items. From here, one last form of analysis was undertaken.

The last analysis was a rank-ordered logistic regression model where ties were permitted in the final ranking. Again, this was meant to provide another perspective on how PAV managers prioritize the various environmental impacts of their buildings' operation. Table 4.15 provides a summary of the results of this analysis. The ranking of the top five items remained the same as all of the other analyses: waste being the highest priority (implied rank: 1), followed by electricity (2), disposables (3), water(4), and lastly food (5). Oil, again, remained the lowest ranked overall. However, in this analysis, the sixth-, seventh-, and eighth-ranked items had another shake up. Gas rose to sixth highest ranked (score: 0.047). Chemicals (0.041) remained in the seventh highest ranked spot. Whereas emissions (0.039) fell to the eighth highest ranked spot. These findings again help to confirm the consistency of the top five highest ranked items, the low priority of oil, and the uncertainty around how to prioritize gas, emissions, and chemicals. Overall, the consistency of the top five ranking is very encouraging for the discussion portion of this study, which will follow in the next chapter.

Unfortunately, this is where the analysis of the BWS data was finished. Since there was insufficient data to accurately run the analysis on smaller groups within the data (e.g., comparing responses from the different types of venues or different sizes of venues), this step was not undertaken since the desired confidence-level of the outcomes could not be achieved. However, compilations of the models considered are provided to ultimately offer a summation of the relative priority levels of the all of the items. The final BWS scores of all the items from all analyses except for the individual ranks from the counts are compiled in Figure 4.4. The individual ranks form the counts were excluded from the graph provided in Figure 4.4 due to the difference in the scale the items were evaluated on. For the individual ranks from counts analysis, having a lower score implied a higher ranking, whereas, for all of the other analyses, having a higher score implied a higher ranking. All of the final implied rankings are compiled in Table 4.16 and this a visual summary of this data is provided in Figure 4.5. This data, again, points to the consistency of waste (final ranking: 1), electricity (2), disposables (3), water (4), and food (5) respectively being the top five highest priority manager-perceived environmental inputs and outputs for these PAV managers as a consequence of the operation of their buildings. As well, oil consistency comes in ranked as the lowest priority of all of these environmental inputs and outputs. As well, there is some disagreement amongst the PAV managers as to how to prioritize emissions, gas, and chemicals beyond that top five aside from the fact that they are outside of the top five priority ranking. When considering that most respondents defined priority as environmental impact of the items or financial impact of the items, it provides depth to an interpretation of these findings, which will be explored in the discussion chapter that will follow.

4.3 NON-BWS PRIORITY IMPRESSIONS OF ITEMS

As a final point of reference in the data, after respondents had completed the BWS exercise portion of the survey, they were asked to provide an overall impression of the priority of each environmental input and output item on a Likert-type scale from one to five with one being lowest priority and five being highest priority. This was done to provide respondents the opportunity to evaluate the overall priority of each item in a non-comparative setting. In BWS, respondents must select either a best or worst option, which means the items compete against one another in each iteration of the task. In this step, respondents simply had to provide an overall impression of the priority of the item, and their rating of one item's priority did not impact their rating of another. Results from this process are summarized in Table 4.17. This analysis provided a similar ranking of the items to the BWS findings; however, while the top five items (in order: waste, electricity, disposables, water, and food) remained the same. The average score for food was much lower than that of the other top five ranked items. As such, an ANOVA was run to compare the means overall priority scores for each item. The results of this ANOVA may be found in Table 4.18. The high F-statistic (34.622) and extremely significant p-value (at alpha level 0.000) suggest that the null hypothesis that here are no mean differences amongst the groups should be rejected and that there are statistically significant differences in the mean priority scores amongst the nine environmental input and output items. This was conducted as a backup to the BWS data should that have not worked, but the findings here do provide evidence that while the top five highest ranked items were similar, that perhaps the item of food is not at the same level of priority as the other four items.

With all of these results in mind, it is now possible to move forward with this study and discuss the findings in greater detail. Therefore, in the chapter that follows, this greater profile of the environmental impacts of a PAV as well as how PAV managers prioritize the various environmental impacts of their buildings will be compared with the literature on the subject. Additionally, managerial implications on the subject will be provided in order to understand the practical impacts of this research and how it could help the PAV industry.

Table 4.1

Frequency Table of PAV Types in the Sample

PAV Type	Frequency	Percent	Valid Percent
Arena	59	26.6	28.6
Stadium	18	8.1	8.7
Theatre	54	24.3	26.2
Convention Center	57	25.7	27.7
Fairgrounds	9	4.1	4.4
Other	9	4.1	4.4
Total	206	92.8	100.0
Missing	16	7.2	-

Table 4.2

Frequency Table of PAV Sizes in the Sample

PAV Type	Frequency	Percent	Valid Percent
Small	44	19.8	22.8
Medium	63	28.4	32.6
Large	86	38.7	44.6
Total	193	86.9	100.0
Missing	29	13.1	-

Table 4.3

Summary of Other Supplemental Data on PAVs in the Sample

Market Size	Frequency	Valid Percent
Primary	88	48.9
Secondary	70	38.9
Tertiary	22	12.2
Total	180	100.0
Region	Frequency	Valid Percent
Region 1	21	11.2
Region 2	22	11.8
Region 3	16	8.6
Region 4	18	9.6
Region 5	42	22.5
Region 6	28	15.0
Region 7	28	15.0
Region IAVM-VMA	8	4.3
Other	4	2.1
Total	187	100.0
University Based	Frequency	Valid Percent
No	161	83.9
Yes	31	16.1
Total	192	100.0
Ownership	Frequency	Valid Percent
Public	136	72.0
Private	53	28.0
Total	189	100.0
Operator	Frequency	Valid Percent
Public	76	40.6
Private	111	59.4
Total	187	100.0
Use Env. Sus. Practices	Frequency	Valid Percent
No	41	21.2
Yes	152	78.8
Total	193	100.0
Track Env. Performance	Frequency	Valid Percent
No	87	45.8
Yes	103	54.2
Total	190	100.0

Table 4.4

Summary of PAV Programs for Each Environmental Impact Item

Program for Oil	Frequency	Valid Percent
No	136	67.3
Yes	66	32.7
Total	202	100.0
Program for Gas	Frequency	Valid Percent
No	124	61.4
Yes	78	38.6
Total	202	100.0
Program for Electricity	Frequency	Valid Percent
No	51	25.2
Yes	151	74.8
Total	202	100.0
Program for Water	Frequency	Valid Percent
No	79	38.7
Yes	125	61.3
Total	204	100.0
Program for Chemicals	Frequency	Valid Percent
No	101	50.0
Yes	101	50.0
Total	202	100.0
Program for Food	Frequency	Valid Percent
No	70	34.1
Yes	135	65.9
Total	205	100.0
Program for Waste	Frequency	Valid Percent
No	36	17.2
Yes	173	82.8
Total	209	100.0
Program for Emissions	Frequency	Valid Percent
No	129	63.9
Yes	73	36.1
Total	202	100.0
Program for Disposables	Frequency	Valid Percent
No	52	25.5
Yes	152	74.5
Total	204	100.0

Table 4.5

Frequency Table of PAV Environmental Sustainability Certifications

Certification	Frequency	Valid Percent
LEED	33	41.2
Energy Star	11	13.8
City	18	22.5
State	12	15.0
ISO 14001	5	6.3
Other	1	1.2
Total	80	100.0

Table 4.6

Frequency Table of Environmental Sustainability Information Sources

Source	Frequency	Valid Percent
Industry Publications	80	35.2
Industry Conferences	91	40.1
Non-profit organizations	43	18.9
Other	13	5.8
Total	227	100.0

Table 4.7

Frequency Table of Overall Priority of Environmental Sustainability

Response	Frequency	Percent	Valid Percent
Very Unimportant	2	0.9	1.0
Somewhat Unimportant	9	4.1	4.4
Neutral	20	9.0	9.9
Somewhat Important	89	40.2	43.8
Very Important	83	37.4	40.9
Total	203	91.4	100.0
Missing	19	8.6	-

Table 4.8

Frequency Table of Definition of Priority for BWS Exercise

Definition	Frequency	Percent	Valid Percent
Financial	58	26.1	27.4
Image	17	7.7	8.0
Environmental	100	45.0	47.2
Competitive	8	3.6	3.8
Regulatory	9	4.1	4.2
Stakeholders	13	5.9	6.1
Other	7	3.2	3.3
Total	212	95.5	100.0
Missing	10	4.5	-

Table 4.9

Hand Count BWS Scores

Items	Total Best	Total Worst	BWS Scores B-W	Mean	SE	Stdev	Implied Rank
Waste	551	85	466	2.099	0.045	0.664	1
Electricity	497	177	320	1.441	0.533	0.794	2
Disposables	414	133	281	1.266	0.048	0.719	3
Water	313	141	162	0.730	0.470	0.700	4
Food	243	345	-102	-0.459	0.054	0.806	5
Emissions	201	420	-219	-0.986	0.054	0.800	6
Gas	160	387	-227	-1.022	0.050	0.742	7
Chemicals	176	424	-248	-1.117	0.052	0.774	8
Oil	96	514	-418	-1.882	0.046	0.683	9

Table 4.10

Initial R Counts Analysis

Item	Count Score	Rank
Waste	0.525	1
Electricity	0.360	2
Disposables	0.316	3
Water	0.182	4
Food	-0.115	5
Emissions	-0.247	6
Gas	-0.256	7
Chemicals	-0.279	8
Oil	-0.471	9

Table 4.11

Individual-Level Proportion of Responses at Each Ranking

	Rank								
Item	1	2	3	4	5	6	7	8	9
Oil	0.9	2.7	6.3	6.3	4.5	8.6	21.6	25.2	23.9
Gas	1.4	3.2	5.4	14.0	16.7	17.1	13.5	17.6	11.3
Electricity	30.2	14.4	12.6	12.2	8.1	6.3	6.3	5.9	4.1
Water	8.6	18.9	12.2	18.5	17.6	7.7	8.6	2.3	5.9
Chemicals	3.6	3.6	7.2	5.0	10.8	21.6	19.4	11.7	17.1
Food	5.0	5.9	13.1	12.6	19.4	5.9	7.2	12.6	18.5
Waste	27.0	21.6	24.3	13.5	6.3	2.3	1.8	2.3	0.9
Emissions	8.1	5.0	4.1	5.9	8.1	19.8	16.7	18.0	14.4
Disposables	15.3	24.8	14.9	12.2	8.6	10.8	5.0	4.5	4.1

Table 4.12

Aggregate Scores of Individual-Level Ranks

Item	Rank Score	Rank
Waste	2.811	1
Electricity	3.513	2
Disposables	3.730	3
Water	4.212	4
Food	5.559	5
Gas	6.023	6
Emissions	6.036	7
Chemicals	6.194	8
Oil	6.923	9

Note. Scores should be interpreted as rankings. Lower scores are higher ranks.

Table 4.13

Conditional Logistic Regression Results

Items	Estimate	SE	z-value	Significance	Implied Rank
Waste	3.142	0.109	28.943	0.000***	1
Electricity	2.142	0.115	18.581	0.000***	2
Disposables	1.899	0.126	15.100	0.000***	3
Water	1.095	0.139	7.871	0.000***	4
Food	-0.716	0.153	-4.692	0.000***	5
Emissions	-1.480	0.130	-11.415	0.000***	6
Gas	-1.541	0.135	-11.452	0.000***	7
Chemicals	-1.682	0.140	-12.044	0.000***	8
Oil	-2.824	0.115	-24.592	0.000***	9

Note. ***significant at alpha level 0.000

Table 4.14

Average Probabilities from Individual-Level Regression

Item	Average Probability	Rank
Waste	0.168	1
Electricity	0.155	2
Disposables	0.144	3
Water	0.125	4
Food	0.096	5
Emissions	0.087	6
Chemicals	0.080	7
Gas	0.080	8
Oil	0.066	9

Table 4.15

Outcome Data for Rank-Ordered Logistic Regression Model with Ties

Item	Average Probability	Rank
Waste	0.204	1
Electricity	0.164	2
Disposables	0.157	3
Water	0.133	4
Food	0.074	5
Gas	0.047	6
Chemicals	0.041	7
Emissions	0.039	8
Oil	0.000	9

Table 4.16

Compilation of Implied Rankings from All Analyses

Item	Hand Count	R Counts	Individual Counts	Aggregate Regression	Individual Regression	Ranked Regression
Waste	1	1	1	1	1	1
Electricity	2	2	2	2	2	2
Disposables	3	3	3	3	3	3
Water	4	4	4	4	4	4
Food	5	5	5	5	5	5
Emissions	6	6	7	6	6	8
Gas	7	7	6	7	8	6
Chemicals	8	8	8	8	7	7
Oil	9	9	9	9	9	9

Table 4.17

Overall Priority Impressions of Each Item

	Item Percentages								
Priority	Oil	Gas	Elec.	Water	Chem.	Food	Waste	Emis.	Disp.
1	37.1	15.0	10.5	7.4	15.1	14.6	0.5	17.8	5.3
2	26.8	31.6	5.7	9.4	27.1	15.6	9.1	28.4	9.6
3	16.1	24.3	13.3	22.2	31.2	24.4	18.2	23.6	20.2
4	12.7	21.8	21.9	24.6	18.1	25.4	23.9	17.3	22.6
5	7.3	7.3	48.6	36.5	8.5	20.0	47.8	13.0	42.3
Mean	2.263	2.748	3.924	3.734	2.779	3.205	4.344	2.793	3.870
Stdev	1.279	1.171	1.339	1.250	1.164	1.327	3.668	1.286	1.215

Table 4.18

ANOVA Table for Overall Priority Impressions

	Sum of Squares	df	Mean Square	F	Significance
Between Groups	808.035	8	101.004	34.622	0.000***
Within Groups	5379.534	1844	2.917		
Total	6187.569	1852			

Note. *** significant at alpha level 0.000

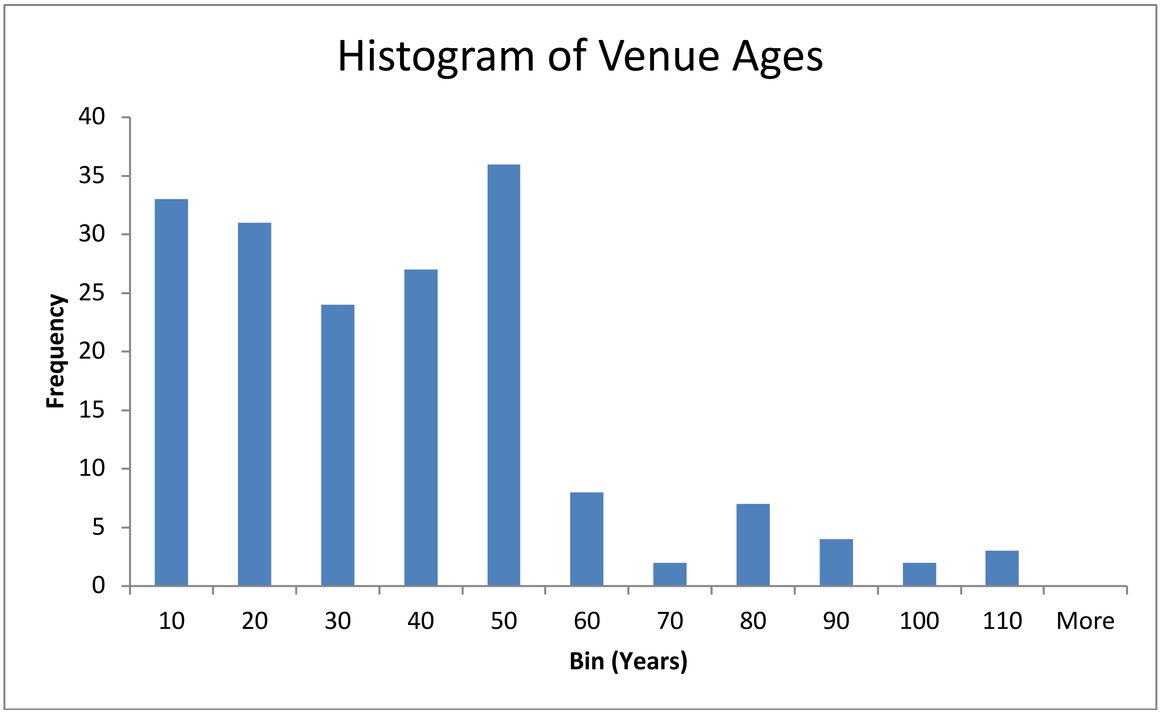

Figure 4.1. Histogram of PAV ages represented in the sample.

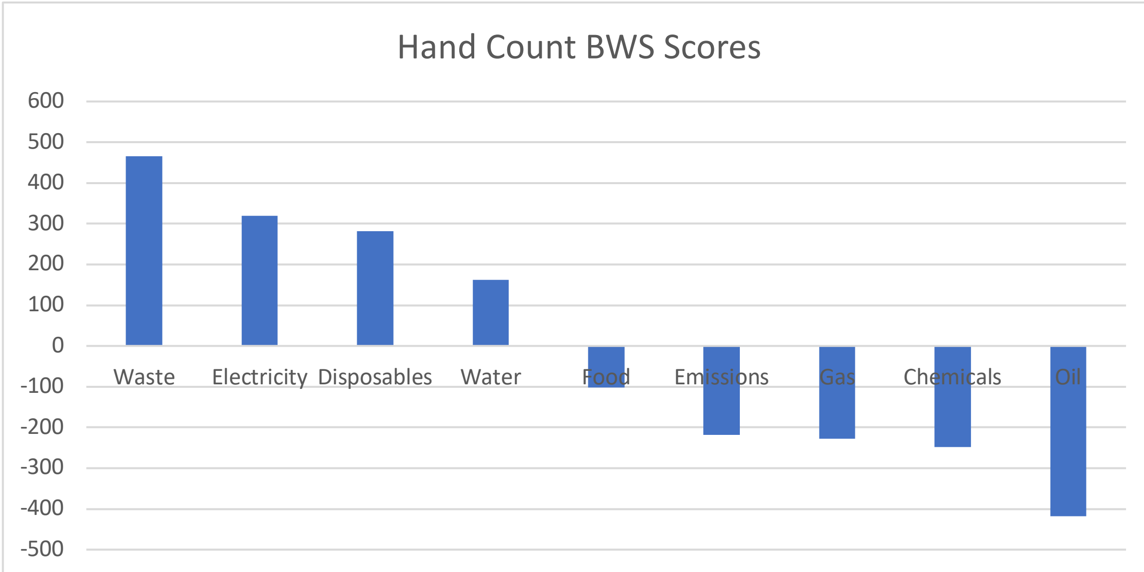

Figure 4.2. Hand count of BWS scores and implied ranking.

	ID	Set	Choice	Oil	Gas	Electricity	Water	Chemicals	Food	Waste	Emissions	Disposables
1	1	1	1	0	0	1	0	0	0	0	0	0
2	1	1	0	0	0	0	0	1	0	0	0	0
3	1	1	0	0	0	0	0	0	0	0	0	1
4	1	2	0	0	0	-1	0	0	0	0	0	0
5	1	2	0	0	0	0	0	-1	0	0	0	0
6	1	2	1	0	0	0	0	0	0	0	0	-1
7	1	3	0	0	1	0	0	0	0	0	0	0
8	1	3	1	0	0	0	0	0	0	1	0	0
9	1	3	0	0	0	0	0	0	0	0	0	1
10	1	4	1	0	-1	0	0	0	0	0	0	0
11	1	4	0	0	0	0	0	0	0	-1	0	0
12	1	4	0	0	0	0	0	0	0	0	0	-1

Figure 4.3. BWS data structured for the logistic regression analysis.

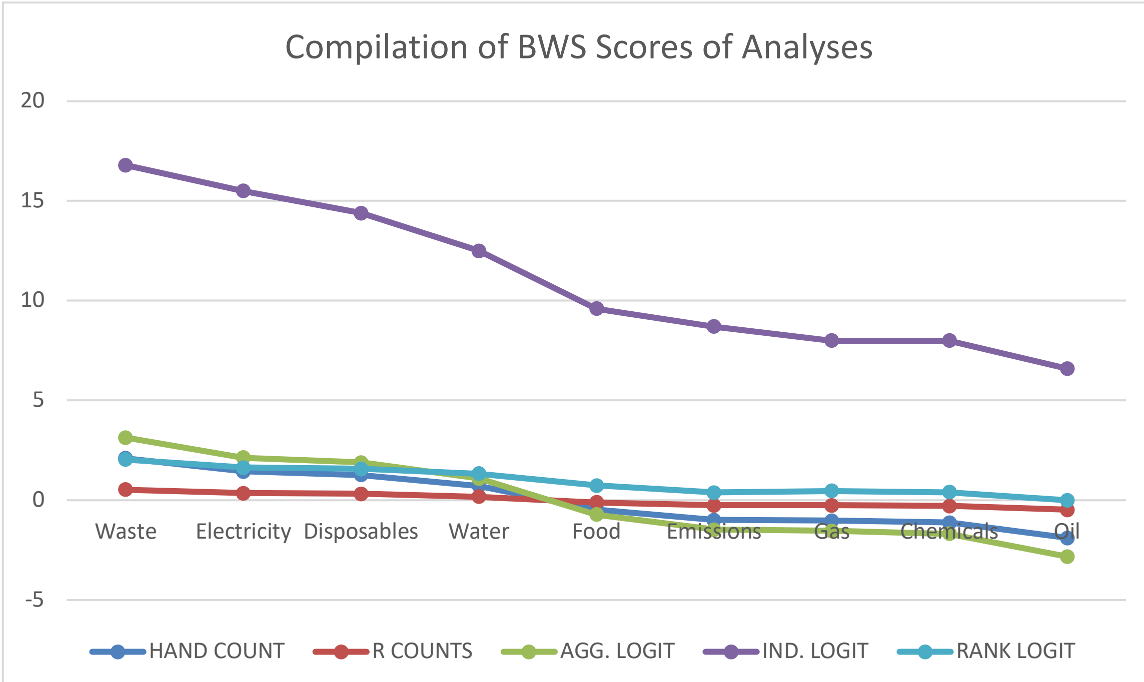

Figure 4.4. Compilation of BWS scores of analyses.

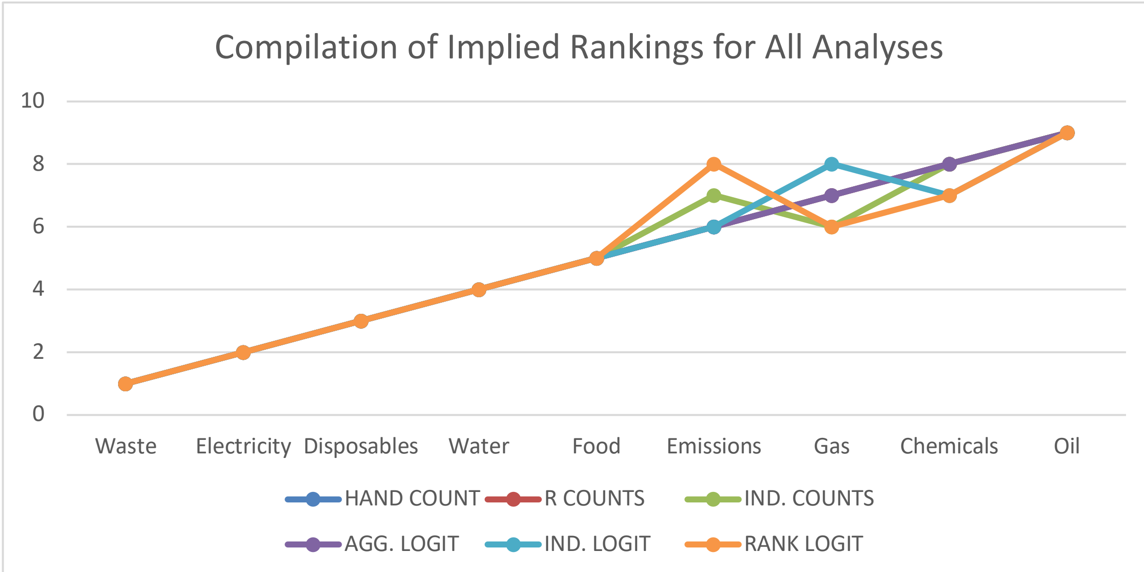

Figure 4.5. Compilation of implied rankings for all analyses.

CHAPTER 5

DISCUSSION

This chapter will explore issues related to an understanding of the findings of the study and its contribution to the general body of knowledge. In particular, it considers how the results of the BWS portion of the study should be interpreted as well as some of the flaws of trusting on this type of data alone. Beyond this, this chapter will explore how the findings of this study contribute to academic literature available on the subject as well as how these findings might impact the PAV industry from a practical standpoint. Lastly, limitations of this study and future directions for this type of research will be presented.

5.1 INTERPRETATION OF THE RESULTS

From the onset of this study, it has been focused upon answering the following research question: of the environmental inputs and outputs in sport and entertainment live event management, which do PAV managers prioritize when making decisions on environmental sustainability within their building? As a reminder, PAVs were chosen as a focal point for this study since PAVs are where most live sport and entertainment events take place as well as for their contribution to overall carbon emissions (Lucon et al, 2014). After the review of the initial list of environmental input and output items, the panel of experts synthesized the environmental inputs and outputs of PAVs to just nine total items combined, which were considered to be those that PAV managers perceive that they actively track and consider when making environmental sustainability decisions. Therefore, they could be viewed as appropriate items since it is what the PAV industry perceives their environmental inputs and outputs to be. Through rigorous data collection that utilized the BWS method of experimental design, and careful analysis of the data, it is believed that the results of the present study appropriately address the original research question. The manager-perceived environmental input and output items that are viewed as the highest priority by PAV managers were wastes, electricity, disposables, water, and food. It was unanimously agreed that oil was the lowest priority environmental input and output item and that emissions, gas, and chemicals were the next lowest-ranked items overall. Thus, PAV managers' overall priority of the environmental input and output items when making decisions regarding environmental sustainability within their building should be interpreted as the follow from highest- to lowest-ranked: waste, electricity, disposables, water, food, emissions, gas, chemicals, and oil. However, it is important to truly understand how it is that this rank order of the priority of environmental inputs and outputs of PAVs should be interpreted. As well, this discussion will address greater overall implications that the findings of this research have on the literature available on the subject as well as for those PAV managers actively working in the industry.

According to Louviere, Flynn, and Marley (2015) BWS as both a discrete choice experiment and theory for analysis is ultimately unable to evaluate the overall evaluation of each item individually as it relies on making comparisons between items. As such, the BWS findings of this study should not be interpreted as PAV managers perceptions of each item's overall level of priority, but rather as each item's priority relative to the others available items from the choice sets. Therefore, the findings can truly only be interpreted to mean that waste is seen as a higher priority of environmental input and output item of a PAV than the other eight items. Or, that water is a higher priority than food, emissions, gas, chemicals, and oil. The reverse can be also be interpreted. For example, that oil is viewed as the lowest priority environmental input and output when compared to the other eight items. It is inappropriate to interpret the findings to suggest that waste by itself is a high priority or that oil is absolutely not a priority, but simply just that waste is the highest priority of the items available and that oil is the lowest priority of the items available. In order to infer the overall priority that could be placed on each item, the supplemental data would need to be considered in conjunction with the BWS data.

Respondents were asked to provide their overall priority evaluation of the items outside of the BWS exercise. This was in order to provide some data that would characterize whether respondents felt that those items were a priority at all rather that in comparison to the other items available in the choice sets. The average priority scores available in Table 4.17 provide data which explores this issue. The highest priority item from the BWS exercise, waste (score out of five: 4.344), was the only item to average a score greater than four, which could be interpreted to mean that it was viewed, on average, as important. Electricity had the next highest average at 3.924, followed by disposables (3.870) and water (3.734). These four items overall are trending towards important on average. However, food, which was ranked as the fifth highest overall priority, shows an average score of 3.205, which suggests that its overall priority was viewed on average as neutral. The remaining items: gas, emissions, chemicals, and oil; all received averages below three, which suggests that they were viewed as a neutral priority and even trending towards unimportant. Using this data as a point of reference alongside the BWS data, it would suggest that while the BWS priority ranking shows the priority of the environmental input and output items in reference to one another, only waste, electricity, disposables, and water are rated as being priorities at all for most PAV managers.

When examining these results in conjunction with whether respondents had an environmental sustainability program in place that was mean to reduce the impact of those items, it also became clear that the four items of waste, electricity, disposables, and water stood out as priorities. Over sixty percent of the PAVs surveyed had some sort of environmental sustainability program in place for each of those four items, along with food: the fifth highest ranked item. In the context of the original research question, this result makes sense that those items which PAV managers prioritize would be the ones to have a mitigation program already in place. The rest of the items had fewer than fifty percent of the PAVs undertaking an environmental sustainability program in regards to those items' impact, which suggests that most PAV managers did not view those items as being a priority. This is an important distinction to make regarding those PAVs that do have programs in place to mitigate environmental impact versus those that do not as it considers the issue of intent or preference versus actual action.

The fact that most of the PAV managers surveyed had environmental sustainability programs in place within their venues for addressing waste, electricity, disposables, water, and food shows that they do back up their placing high priority on those items by action upon those environmental impacts. The gap between surveying participants' preferences or intentions versus their actual behavior is a well-noted issue within survey research – particularly with purchasing behaviors (Chandon, Morwitz, & Reinartz, 2005). This gap was also investigated by Johnson and Ali (2018) in their examination of potential dissonance between the NHL Sustainability program and its actual impact upon the environment. Due to the findings of the supplemental data supporting the findings from the BWS data, it could be inferred that not only are waste, electricity, disposables, and water high priorities in terms of response, but also in terms of actual behavior of these PAV managers. Additionally, those environmental inputs and outputs that were rated as a lower priority are also those that are not currently being implemented in most venues. However, this could also be interpreted to mean that waste, electricity, disposables, and water are only highly ranked as priorities because of the fact that they are the items that most PAV managers are already acting upon. Therefore, their responses were biased towards the environmental sustainability initiatives that they are already actively working on.

Another related issue with surveying participants includes participants responding with what they believe to be the most socially desirable response rather than with what they actually believe to be true (Randall & Fernandes, 1991). This suggests that participants respond to surveys with answers that are not what they truly believe as individuals, but with what they believe to be the responses that would be the most positively received by society. Therefore, respondents are perhaps hiding their true preferences and biasing responses towards those that are popular. This is a flaw with any survey or instrument that involves participants self-reporting their responses (Randall & Fernandes, 1991). Similar to socially desirable response bias is the issue of "greenwashing:" the practice of deceptively promoting products and services as environmentally friendly when they are truly not environmentally friendly. This is another common issue in sport management (e.g., Boykoff & Mascarenhas, 2016; Johnson & Ali, 2018). Since the highest priority items are those which PAV manager respondents had programs in place for already, it is not believed that participants were greenwashing their responses in order to appear more environmentally friendly – since that is often considered to be a socially desirable response. Survey questions were worded carefully to ensure that respondents would not be biased towards particular answers; however, it is simply important to point out that this is an issue which may have impacted responses in this survey.

Perhaps, the most impactful interpretation of the BWS findings comes from understanding how the PAV manager respondents defined the use of priority in their mind while completing the exercise. Almost half of respondents (47.2 percent) of respondents defined priority in terms of the environmental impact that the nine manager-perceived environmental input and output items. This suggests that many of the responses should be interpreted as having prioritized items based on the respondents' perceptions of the overall environmental impact of those items. Therefore, respondents would believe that waste has one of the highest levels of environmental impact, followed by the consumption of electricity, and all the way down through the rank-ordered list to see that the environmental impact of oil consumption and waste was perceived as low in its environmental impact compared to the other items. However, this does beg the question of whether those items that are ranked as a high priority are actually those that have a large impact on the environment. Perhaps some of the items that were ranked as a lower priority have a large environmental impact but were not perceived to have a higher impact by PAV manager respondents. The next highest definition of priority (27.4 percent of responses) was the financial impact of the nine environmental input and output items. In this case, responses should be interpreted as higher priority based on their financial impact upon the PAV. Wastes could therefore be considered to be the most expensive of the environmental inputs and outputs on the decision-making process of the operation of the venues followed by electricity consumption, and down through the list until ultimately oil consumption and disposal is deemed the least financially impactful priority. Yet, understanding these definitions still does not completely cover the gap between respondents' intentions with respect to the priority placed on each of these PAV environmental inputs and outputs and their actual behaviors with respect to environmental sustainability.

This ultimately merely shows what these PAV managers perceive to be the relative priority of these environmental inputs and outputs when making decisions on environmental sustainability in their buildings. A measure of how PAV managers prioritize these items that would create a clearer picture of actual priority would be to measure how they spend their limited budget with respect to environmentally sustainable practices. Seeing how PAV managers actually spend money on environmental sustainability projects around their buildings would yield a more definitive understanding of how they truly prioritize each environmental input and output of the operation of their building. That is not to suggest that the findings from the present study are insufficient, but merely that they do not necessarily paint the whole picture of PAV managerial priority of environmental inputs and outputs since it was dependent upon respondents' intentions, beliefs, and opinions, rather than their actual behavior.

Overall, the findings of this study suggest that PAV managers prioritize handling wastes, electricity consumption, use of disposable products, and the consumption and disposal of water the most as environmental inputs and outputs when making decisions regarding environmental sustainability with their buildings. From here, it is now possible to consider how these findings contribute to the literature on environmental sustainability in sport and entertainment live event management as well as LCA theory.

5.2 THEORETICAL CONTRIBUTIONS OF THIS STUDY

This study offers multiple contributions to academic literature and theory: from contributing to the sport and entertainment live event management literature, to the use of the BWS, and the use of LCA as a theoretical framework. All of these contributions will be addressed in more detail in the section that follows.

The first major contribution of this research is that it helps to address what Mallen and colleagues (2011) as well as Mallen (2018), based on the SE-EPM model, determined was a significant gap in the literature on environmental sustainability in sport management. Notably, there was little to no research available which addressed the theme of environmental operational performance and its subthemes of environmental inputs and outputs (Mallen, 2018). The present research attempted to help fill the gap in the literature by not only characterizing the various manager-perceived environmental inputs and outputs of a PAV, where more sport and entertainment live events take place, but by also providing an idea of PAV managers prioritize those various environmental inputs and outputs when making decisions regarding environmental sustainability within their buildings. A considerable portion of the previous research on the topic of environmental sustainability in sport and entertainment live event management had been focused on covering basic environmental sustainability knowledge on the topic, understanding stakeholders to environmental sustainability in sport (e.g., managers, marketing, and consumers), as well as operational countermeasures to combat negative environmental impacts (Mallen, 2018). Thus, this was one of the first studies which has helped to characterize the actual environmental impact that sport and entertainment live events have on their communities.

While there had been a handful of studies that have attempted to address this inputs and outputs gap (e.g., Chard & Mallen, 2012; Dolf & Teehan, 2015; Wicker, 2018), these studies were all focused on travel of teams and spectators to the events themselves. Therefore, none of these have been focused on the buildings in which sport and entertainment live events take place. It is important to have this understanding of PAVs in particular since buildings are one of the largest sources of greenhouse gas emissions (Lucon et al, 2014). Travel is certainly another large source of greenhouse gas emissions for the live events industry; however, it would not be prudent to ignore the impact that buildings have on the environment as well.

Another area of concern for this study was the initial use of the SE-EPM model from Mallen and colleagues (2010), which was based on the EPM model from Xie and Hayase (2007). While this model may be an accurate representation of the various environmental inputs and outputs of an event, it is only partially applicable to the buildings in which those events may be held. Based on the literature review, information from GSA (2018b), NDRC (2019), and NHL (2018), and the review of the SE-EPM items by the panel of experts, it seems that the SE-EPM is not what the PAV industry utilizes when conceptualizing their environmental impact. Many of the items available in the SE-EPM, while measurable and impactful upon the environment, are simply not items that PAV managers are considering. For example, the GSA (2018b), NDRC (2019), and NHL (2018) all did not consider items like oil or emissions in their assessments of the environmental impact of sport in particular. Those sources were more immediately focused on items like wastes, electricity, and water. And, those items were shown to be a high priority by the PAV managers surveyed. Further, some of the items from the SE-EPM were consolidated into single items that represented larger groups of items (e.g., carbon dioxide, sulfur dioxide, and nitrogen dioxide being combined into emissions). Again, it seems that while the SE-EPM may be a good model for academic use in evaluating the environmental impact of sport and entertainment live events, it is not a standard by which the industry itself is utilizing in assessing its own environmental impact.

With regard to the use of LCA as a theoretical perspective for this study, it was useful in creating the whole profile of the manager-perceived environmental inputs and outputs for a PAV. The findings of this study should be interpreted as PAV managers' perceptions of the overall priority of those various environmental inputs and outputs when they make decisions on environmental sustainability within their buildings, but also as an assessment of their perception of how PAV operation impacts the environment. The present research also further extends the use of LCA into sport and entertainment live event management research via its application to PAVs. Previous research in this field that has utilized LCA has been focused on either team and spectator travel to the events (e.g., Dolf & Teehan, 2015; Wicker, 2018) or has been focused on managing wastes at such events (e.g., Costello, McGarvey, & Birisci, 2017). The present study was therefore the first attempt at using LCA to conceptualize the environmental impact of PAVs within this field.

However, there is a shortcoming to the use of LCA in the present research to consider. Namely, that LCA is meant to consider the total environmental impact of an good or service from creation to destruction (McDonough & Brauntgart, 2002). Since the present research was only focused on how the PAV operates, it was not able to fully develop an understanding of how the PAV impacts the natural environmental from the conception of the venue, through construction and operation, and ultimately its demise at the end of its operational lifetime. This limited LCA was purposefully undertaken as PAV managers who operate the venue are not necessarily able to contribute to the design, construction, and demolition of the venue – but merely the operation. However, this study was able to follow two of the four outlined steps for proper completion of an LCA: goal and scope definition and inventory analysis (ISO, 2006a; ISO, 2006b). The goal and scope of the study were defined from the outset as meant to develop an understanding of what the environmental impacts of the operation of the PAV are. As such, this LCA did not intend to cover the construction and demolition phases of a PAV. With this goal and scope in mind, this portion of the LCA was successful. Secondly, the LCA required an inventory analysis of the potential impacts of the environmental inputs and outputs of PAV (Finnveden et al, 2009). This portion was also successfully completed as the inventory of environmental inputs and outputs created the nine items that were ultimately used in the BWS exercise by PAV manager respondents. Therefore, while this was not a complete LCA of a PAV, it was a successful start to understanding, at the least, the operational phase of the life of a PAV. For that reason, LCA was an appropriate framework for conceptualizing these environmental impacts. Future research of this topic should consider extending this LCA to be a full analysis of the life of a PAV and its impact on its community's natural environment.

The final theoretical contribution of the present study concerns the use of the BWS. Following in the footsteps of O'Reilly and Huybers (2015), this is only the second time that the BWS method of analysis was been utilized in sport management and a first for sport and entertainment live event management. This is a very popular method of analysis in marketing-, sponsorship-, and consumer behavior-related studies; however, it has practical use for analysis outside of that context and the present research exemplifies one such use. Since BWS is a method of choice modeling (Louviere et al, 2015), it could be used to model preferences of much more that would be useful to the sport management discipline. A few examples of such use might include: understanding what practitioners look for in potential hires, investigating consumers' preferences for game day experiences, sport tourism experiences, and understanding academics perception of the quality of journals in the discipline. Thus, the present research echoes the call by O'Reilly and Huybers (2015) for more use of BWS in sport management.

With all of these theoretical contributions in mind, the focus of this discussion will shift to addressing the practical contributions of the present research. This is important since the present research was dependent upon practitioners working as PAV managers to complete the survey and BWS exercise. Thus, there ought to be some benefit to them for their participation. These contributions will be addressed in the section that follows.

5.3 PRACTICAL CONTRIBUTIONS OF THIS STUDY

There are several practical contributions of the present research for those currently working in the PAV industry or the sport and entertainment live events industry. These include having a better understanding of PAV managers perspective on their environmental impact, how they prioritize the various environmental impacts of their PAV, targeting solutions to the issues of most concern to these PAV managers, as well as directing future academic research to benefits the needs of PAV managers. All of these contributions will be discussed in more detail in the section that follows.

First, the present research provides an overall perspective of how PAV managers view the environmental impact as well as how they prioritize those impacts. As has been previously stated, this is limited to the operational phase of the PAV and not the construction or demolition of the PAV; however, it is now understood that PAV managers characterize the environmental impact of their building via the nine environmental input and output items utilized in this research. Of those nine items, it is now understood that PAV managers prioritize waste, electricity, use of disposable products, and water above all of the other items. It makes sense that these items would be higher priorities for a few reasons First, they are impactful from an environmental standpoint and therefore the focus of much environmental literature and dialogue. Therefore, they may also be items of high-profile environmental impact since there is considerable public attention given to reducing waste, electrical use, product use, and water use. Another reason they would be higher priorities would include that they are also items of high cost to those PAV managers. Waste, electricity, and water consumption in particular are high-expenditure items in any PAV budget. One final possible cause for their high priority would be that these are items that are currently easily measurable. PAVs likely already track waste disposal, electrical consumption, disposable product use, and water consumption for financial reasons. It would be easy to focus on those same impacts and utilize the same metrics when focused upon reducing environmental impact. Although, it should be noted that those higher priority items are not necessarily those with an actual higher impact on the environment.

On the other side of the spectrum, the environmental impact, profile, and budget for oil, chemicals and cleaning products, or capturing emissions might be quite low compared to those of the other items. These may also be items that yield little return on investment for financial investment into reducing those environmental impacts and are not easily measurable with respect to quantifying impact and reduction. It is also worthwhile to note that just because these items ranked lower than the others, does not mean that they are not valuable. It is possible that PAV managers do value those impacts, but are simply not tracking or actively working with those impacts in comparison. The two remaining items, gas and food, yielded interesting rankings. Gas would make sense as a higher priority, but it is possible that not all PAVs actually use natural gas or any other gasoline products in their operation, whereas every PAV needs electricity and water. Food as another item fell in the middle of the priority rankings, but this could be explained by the fact that many PAVs likely outsource food services to companies like Aramark, Delaware North, or Centerplate. Those PAVs which outsource to such organizations, likely do not see the environmental or financial impact of food consumption and waste. This again shows that an impact such as food may not be perceived as without value, but rather may simply be the victim of not being actively tracked or engaged with by PAV managers in comparison to the other impacts since food is often outsourced. Regardless, the fact of the matter remains that the present research provides a clear understanding that with respect to the environmental inputs and outputs of a PAV, managers prioritize waste, electricity, disposables, and water above all other potential environmental impacts.

Related to this contribution, the findings of the present research should direct future environmental sustainability efforts in PAVs and sport and entertainment live event management towards these environmental inputs and outputs that are the highest priority to those in charge to implementing environmental sustainability efforts. In other words, solutions to environmental sustainability issues within PAVs should be directed towards the environmental impact items of waste management, electricity consumption, disposable products use, and water consumption and discharge. Moving environmental sustainability forward in this industry means working with stakeholders like PAV managers, and the findings suggest that the environmental sustainability efforts that they will prioritize with respect to time, money, or effort will be these items. PAV managers appear to not be prioritizing environmental sustainability efforts that relate to oil use, gas consumption, emissions, or the use of chemicals. Therefore, those may not be the issues that those wishing to drive environmental sustainability forward in this industry should be focusing their time and efforts on at the moment since PAV managers will not be making those a priority. However, it may be worth future efforts in the PAV industry to focus on how to make those lower priority items a higher priority overall if they are truly impactful on the natural environment. This would also help move environmental sustainability forward in this industry.

Lastly, future academic research conducted on the subject that is meant to benefit PAV managers and the sport and entertainment live event industry should also be focused on issues of waste management, electricity consumption, disposable products use, and water consumption and discharge or on how to improve the overall priority of those lower priority items like oil, emissions, gas, chemical use, and food. While research that has been conducted on the environmental impact of emissions at sport events (e.g., Bunds, Casper, Frey, & Barrett, 2019), this is likely not research that most PAV managers would find useful in managing the environmental impacts of their buildings or events held within them. Further, the data suggests that most PAV managers are getting information on environmental sustainability within their industry from industry-focused sources like publications and conferences. Therefore, findings from research that would be to the benefit of PAV managers and the sport and entertainment live events industry ought to be distributed to the industry via their own industry-focused sources since that would be an effective method of ensuring that many PAV managers see the research rather only a select few who might already be inclined to seek out information on the subject. Additionally, this finding also suggests that most information on the topic of environmental sustainability in PAVs is shared amongst peers within the industry rather than being sought from outside sources – like academic journals. In order to disseminate information within the industry it may need to be shared with a few environmental champion PAV managers who would then be able to share it with the wider PAV industry. Lastly, it would be advisable to include managerial implications or an executive summary of published academic research that could be easily distributed to PAV managers via their own sources. These actions would bring the academic research together better with the industry and its own resources.

Ultimately, the most practical impact of the present research will be that it should open door for future research to be carried out on the topic of environmental sustainability in PAVs and in the sport and entertainment live events that would be to the benefit of practitioners of the future. Such potential avenues of research, as well as the limitations of the present research, will be discussed in greater detail in the section that will follow.

5.4 LIMITATIONS AND FUTURE DIRECTIONS

Many of the limitations of the present research have already been mentioned, but this section will explore those limitations in greater detail as well as offer future directions for research on this topic. Perhaps one of the largest limitations of the present study was the lack of sufficient responses to conduct comparative analyses with the BWS data. While the 222 responses were sufficient for running the BWS data and drawing conclusions that the present study has offered, there were insufficient responses to reliably draw comparisons between types of PAV (e.g., arenas versus performing arts centers versus stadiums), size of PAV, market size, definition of priority, or any of the other identifiers from the supplemental data. While it is difficult to reach PAV managers due to the constraints of their profession, a future replication of this study ought to make an attempt to gather at least 400 responses so that such comparisons could be made (Lipovetsky et al, 2015). Such data may reveal differences between those PAVs that are large versus small or indoor versus outdoor, amongst many other differences. It would seem likely that there are differences in prioritization amongst the environmental inputs and outputs that are dependent upon the context of the PAV. For example, an outdoor PAV may have lower electricity priority compared to indoor PAVs since they do not need to run air conditioning and heating at nearly the same capacity as indoor PAVs and therefore spend less on electricity. Or, outdoor PAVs may have higher water priority than an indoor PAV due to the need to water grass and landscaping that an indoor PAV does not require at the same scale. Such differences could be explored via a larger sample of PAV manager respondents.

Two further issues related to the survey process should be noted as well. First, the desire of the survey was to obtain professional responses of a diverse sample of PAV managers based on their understanding of the operation of their own PAV; however, there is no guaranteed method of ensuring that the responses collected were professional and not necessarily the privately held responses of the individuals' who completed the survey. Second, it was seen in the data that the majority of PAVs represented in the sample had some sort of environmental sustainability program in place in their venue. It is possible that the responses collected were biased towards PAVs with environmental sustainability programs already in place since those venues would be more likely to respond to a survey on the topic of environmental sustainability in PAVs. It is not belived that either of these limitations biased the data in a significant manner, but they are worth mentioning as limitations of survey research in general.

Another issue mentioned during this discussion concerned the difference between respondents intents versus their actual actions (Chandon et al, 2005) or that they may respond with socially desirable responses rather than their actual preference (Randall & Fernandes, 1991). While it is believed that such biases did not affect the data collected for the present study, and that the findings are therefore valid, it would be possible to avoid such biases altogether via alternative methods of data collection. A future study could examine how PAV managers spend their limited budgets – especially how they spend on projects related to environmental sustainability. Seeing where the money in the PAV industry gets spent would provide further clarity to managerial priority placed on the environmental inputs and outputs of their buildings. Those environmental inputs and outputs that receive large levels of funding would likely be the highest priority items and that those that are unfunded would been less of a priority. However, asking PAV managers, even with complete anonymity, to provide details on their budgets and spending would be difficult as many are unwilling to share such information. For that reason, it was not attempted in the present research.

The final limitation is the overall scope of the LCA for this study. The scope was purposefully defined to be narrow in order to examine only the operational phase of a PAV as most PAVs exist in this phase rather than the design, construction, and demolitions phase. Additionally, PAV managers who are concerned with day-to-day operations of the venue are usually not contributors in the design, construction, and demolition processes of the PAV. Thus, PAV manager contributions to this study should concern the operations phase of the venue. The present study also did not attempt to quantify the environmental inputs and outputs of the PAVs in terms that measure environmental impact, which is a future step of the present research. Another future study could extend the findings of this LCA to the whole life of the PAV from design until destruction. This would be possible via studying the environmental impacts of PAVs currently in design, those under construction, and then those that are at the end of their lives. This study would provide a more robust overall understanding of how a PAV impacts the natural environment of its community. Findings of such a study could be used to help direct solutions to issues of environmental sustainability in PAVs for practitioners at every point in the lifecycle of a PAV. Yet, it should be noted that the present research was thorough in its scope and provided an important first step in understanding the environmental impact of PAVs as well as how those individuals that manage the day-to-day operations prioritize those impacts in their decision-making process.

Lastly, there is one more interesting finding that has the potential for future study. Similar to findings from Mercado and Walker (2016), many of the PAVs represented in this sample were publicly-owned and privately-operated. It seems that PAVs with this type of owner-operation arrangement are more willing to participate in such research and share their experiences when compared to privately-owned and operated PAVs. The reason for this is not immediately clear; however, should be investigated further in the future.

5.5 MAJOR TAKEAWAYS

In order to highlight the more practical contributions of this research in a manner that is appropriate for the practitioner audience, the following four major takeaways are summarized below and will provide a template for potential future presentations at industry-focused conferences:

- The highest priority perceived environmental impacts were waste, electricity, disposable products use, and water. These impacts are all points of decision that a PAV operations manager can make adjustments to without making large-scale changes to the PAV itself or infrastructure within the PAV. Small behavioral or procedural changes can drastically reduce consumption of all of these resources, creation of related wastes, and thereby reduce the overall environmental impact. Such behavioral changes could include: reduction of electrical or water use during peak periods or decreasing use of disposable single-use products which would also reduce waste created. Since these are higher priority items, there should be more information available to PAV managers on reducing the environmental impact of these items. Reduction of these environmental impacts could also lead to a reduction of operational costs of the PAV.

- The lower priority perceived environmental impacts of food, gas, emissions, chemicals, and oil are areas of growth for the PAV industry with regard to reducing its environmental impact. Despite their lower priority in the BWS rankings, this does not mean that their actual environmental impacts are smaller. Behavioral changes could aid in reduction of these environmental impacts; however, in some cases, larger-scale changes would be required. For example, switching from a diesel backup generator, to one powered by alternative sources like solar.
- In many cases, a possible first step towards reducing impacts are small behavior changes to reduce consumption and output creation. Alternatively, making infrastructural changes piece-by-piece instead of at the whole scale may lessen the financial burden of upgrading infrastructure while reducing environmental impact.

- Lastly, it is okay to ask for help from peers when it is needed. Some PAVs in this industry are more advanced on the environmental sustainability front than their peers and should serve as examples for the rest of the industry. Using peers, as well as resources like the IAVM, GSA, NRDC, USGBC, and others are potential sources for obtaining information related to these environmental impacts and implementing changes in the operation of the PAV.

Overall, it is believed that these four major takeaways are appropriate for a practitioner audience and would be useful to those actively working in this industry to advance its efforts with respect to environmental sustainability.

5.6 CONCLUSIONS

Starting with the question of how do PAV managers prioritize the various environmental inputs and outputs of a PAV when making decisions on environmental sustainability within their building, it is believed that the present research fully and appropriately answered this question. Findings from this study show support for waste, electricity, disposables products use, and water as the highest priority environmental inputs and outputs for PAV managers. At the other end of the spectrum, from lowest priority up to higher priority, oil, chemicals, gas, emissions, and food were at the lower end of the spectrum as priorities for the PAV managers surveyed. These findings help to extend the use of BWS in sport management research and provide a clear sense of the priorities of PAV managers when it comes to prioritization of environmental sustainability within their buildings. It is hoped that the findings of this research will contribute to closing the gap between academic research and the industry on the subject and that they will lend a hand to efforts to make the sport and entertainment live events industry more environmentally sustainable in the future.

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APPENDIX A

PAV MANAGER ENVIRONMENTAL PRIORITY SURVEY

Start of Block: Default Question Block

Q1 Thank you for taking the time to complete this survey. My name is Walker Ross and I am a doctoral student in the Sport and Entertainment Management Department at the University of South Carolina. I am conducting a research study as part of the requirements of my doctoral degree and I would like to invite you to participate. This research concerns public assembly venue manager perspectives on the environmental impact of their buildings and spaces. To qualify, you must be or have been a professional working in a public assembly venue. In the questions that follow, you will be asked to consider a small number of potential environmental impacts of a public assembly venue's operation. From this list, you are asked to select that environmental impact which you view as the highest priority and that which you view as the lowest priority from the operations standpoint of your venue. Additionally, there are some questions regarding the type of public assembly venue you represent. The survey should take no more than 5 minutes to complete. Participation is confidential. Study information will be kept in a secure location at the University of South Carolina. The results of the study may be published or presented at professional meetings, but your identity will not be revealed. Taking part in this study is your decision. There are no anticipated risks or benefits. You may quit at any time and may decline to answer questions that you are uncomfortable answering. If you have any questions you have about the study, I would be happy to answer them. You may contact me at wjross@email.sc.edu or 803-777-1166. Or, you may contact my faculty advisor, Dr. Haylee Mercado at mercadoh@mailbox.sc.edu or 803-777-7087. If you have any questions about your rights as a research participant, you may contact the Office of Research Compliance at the University of South Carolina at 803-777-7095. UofSC IRB # Pro00086143 Please choose the appropriate response to continue with the survey and click the red arrow button to continue.

○ Yes, I wish to continue with this survey. (1)

○ No, I do not wish to continue with this survey. (2)

Skip To: End of Survey If Q1 = No, I do not wish to continue with this survey.

Q1 In the questions that follow, you will be asked to consider a small number of potential environmental impacts of a public assembly venue's operation from the larger list provided below. From this small group, you are asked to select that environmental impact which you view as the highest priority from a venue operations standpoint and that which you view as the lowest priority from a venue operations standpoint. Interpretation of "highest priority" and "lowest priority" is up to you.

Please note, you will be shown three options in each set, but will only be able to select one as highest priority and one as lowest priority. The last option will be left unselected. There are a total of twelve sets to answer.

Here are the impacts that you will see presented:
1. Oil (e.g., use of oils to lubricate equipment)
2. Gas (e.g., use of natural gas)
3. Electricity (e.g., use of electricity to power the venue)
4. Water (e.g., use of water for toilets, cleaning, drinking, and producing ice)
5. Chemicals (e.g., use of chemical products in cleaning or in producing ice)
6. Food (e.g., consumption and disposal of food within the venue)
7. Waste (e.g., trash, recycling, battery recycling, e-wastes)
8. Emissions (e.g., fumes from running motors, generators, or other power equipment)
9. Disposables (e.g., use of single-use products like napkins, food containers, etc.)

Page Break

Q3 (1/12) With regard to the environmental impact of your venue's operation, which of the impacts listed below do you consider to be the highest priority and which do you consider to be the lowest priority?

Highest Priority (1)		Lowest Priority (2)
○	⊗ Electricity (1)	○
○	⊗ Chemical (2)	○
○	⊗ Disposables (3)	○

Page Break

Q4 (2/12) With regard to the environmental impact of your venue's operation, which of the impacts listed below do you consider to be the highest priority and which do you consider to be the lowest priority?

Highest Priority (1)		Lowest Priority (2)
○	⊗ Gas (1)	○
○	⊗ Waste (2)	○
○	⊗ Disposables (3)	○

Page Break

Q5 (3/12) With regard to the environmental impact of your venue's operation, which of the impacts listed below do you consider to be the highest priority and which do you consider to be the lowest priority?

Highest Priority (1)		Lowest Priority (2)
○	⊗ Oil (1)	○
○	⊗ Gas (2)	○
○	⊗ Electricity (3)	○

Page Break

Q6 (4/12) With regard to the environmental impact of your venue's operation, which of the impacts listed below do you consider to be the highest priority and which do you consider to be the lowest priority?

Highest Priority (1)		Lowest Priority (2)
○	⊗ Gas (1)	○
○	⊗ Water (2)	○
○	⊗ Food (3)	○

Page Break

Q7 (5/12) With regard to the environmental impact of your venue's operation, which of the impacts listed below do you consider to be the highest priority and which do you consider to be the lowest priority?

Highest Priority (1)		Lowest Priority (2)
○	⊗ Oil (1)	○
○	⊗ Waste (2)	○
○	⊗ Emissions (3)	○

Page Break

Q8 (6/12) With regard to the environmental impact of your venue's operation, which of the impacts listed below do you consider to be the highest priority and which do you consider to be the lowest priority?

Highest Priority (1)		Lowest Priority (2)
○	⊗ Oil (1)	○
○	⊗ Chemical (2)	○
○	⊗ Food (3)	○

Page Break

Q9 (7/12) With regard to the environmental impact of your venue's operation, which of the impacts listed below do you consider to be the highest priority and which do you consider to be the lowest priority?

Highest Priority (1)		Lowest Priority (2)
○	⊗ Food (1)	○
○	⊗ Emissions (2)	○
○	⊗ Disposables (3)	○

Page Break

Q10 (8/12) With regard to the environmental impact of your venue's operation, which of the impacts listed below do you consider to be the highest priority and which do you consider to be the lowest priority?

Highest Priority (1)		Lowest Priority (2)
○	⊗ Electricity (1)	○
○	⊗ Water (2)	○
○	⊗ Emissions (3)	○

Page Break

Q11 (9/12) With regard to the environmental impact of your venue's operation, which of the impacts listed below do you consider to be the highest priority and which do you consider to be the lowest priority?

Highest Priority (1)		Lowest Priority (2)
○	⊗ Water (1)	○
○	⊗ Chemical (2)	○
○	⊗ Waste (3)	○

Page Break

Q12 (10/12) With regard to the environmental impact of your venue's operation, which of the impacts listed below do you consider to be the highest priority and which do you consider to be the lowest priority?

Highest Priority (1)		Lowest Priority (2)
○	⊗ Gas (1)	○
○	⊗ Chemical (2)	○
○	⊗ Emissions (3)	○

Page Break

Q13 (11/12) With regard to the environmental impact of your venue's operation, which of the impacts listed below do you consider to be the highest priority and which do you consider to be the lowest priority?

Highest Priority (1)		Lowest Priority (2)
○	⊗ Oil (1)	○
○	⊗ Water (2)	○
○	⊗ Disposables (3)	○

Page Break

Q14 (12/12) With regard to the environmental impact of your venue's operation, which of the impacts listed below do you consider to be the highest priority and which do you consider to be the lowest priority?

Highest Priority (1)		Lowest Priority (2)
○	⊗ Electricity (1)	○
○	⊗ Food (2)	○
○	⊗ Waste (3)	○

Page Break

Q15 Please provide your rating of the level of priority of each of the environmental impacts of a public assembly venue (1 = lowest priority, to 5 = highest priority)

	Lowest Priority 1 (1)	2 (2)	3 (3)	4 (4)	Highest Priority 5 (5)
Oil (1)	○	○	○	○	○
Gas (2)	○	○	○	○	○
Electricity (3)	○	○	○	○	○
Water (4)	○	○	○	○	○
Chemical (5)	○	○	○	○	○
Food (6)	○	○	○	○	○
Waste (7)	○	○	○	○	○
Emissions (8)	○	○	○	○	○
Disposables (9)	○	○	○	○	○

Q31 Of those environmental considerations of a public assembly utilized in this survey, do you have a program in place to address or minimize the environmental impact of each?

	No (1)	Yes (3)
Oil (1)	○	○
Gas (2)	○	○
Electricity (3)	○	○
Water (4)	○	○
Chemical (5)	○	○
Food (6)	○	○
Waste (7)	○	○
Emissions (8)	○	○
Disposables (9)	○	○

Q16 The definition of priority of the environmental impacts of a public assembly venue was left to you to interpret in the previous questions. Which of the following choices best describes how you determined priority when selecting responses before?

○ Financial impact on the venue (1)

○ Image of impact on the venue (2)

○ Environmental impact on the venue (3)

○ Competitive impact on the venue (4)

○ Regulatory impact on the venue (5)

○ Impact of stakeholders on the venue (7)

○ Other (please explain) (6) ____

End of Block: Default Question Block

Start of Block: Block 1

Q17 The final set of questions require descriptive information on your public assembly venue and are completely anonymous. Your answers cannot be tied to you individually or the venue that you represent. If you feel uncomfortable answering any question, please select or write in the text box provided "I'd rather not answer"

Q18 What type of public assembly venue do you work in (you may choose more than one)?

- ☐ Arena/Civic Center (1)
- ☐ Stadium (2)
- ☐ Theatre/Performing Arts Center (3)
- ☐ Convention Center/Exhibit Hall (4)
- ☐ Fairgrounds (8)
- ☐ Other (please specify) (6) ____________________
- ☐ I'd rather not answer (7)

Display This Question:

If Q18 = Arena/Civic Center

Q19 What is the size of your arena?

- ○ Small (up to 7,500 capacity) (1)
- ○ Medium (7,501 - 12,000 capacity) (2)
- ○ Large (over 12,000 capacity (3)
- ○ I'd rather not answer (4)

Display This Question:

If Q18 = Stadium

Q32 What is the size of your stadium?

- Small (up to 15,000 capacity) (1)
- Medium (15,001 - 35,000 capacity) (2)
- Large (over 35,000 capacity) (3)
- I'd rather not answer (4)

Display This Question:

If Q18 = Theatre/Performing Arts Center

Q33 What is the size of your theater/performing arts center?

- Small (up to 1,500 capacity) (1)
- Medium (1,501 to 2,500 capacity) (2)
- Large (over 2,500 capacity) (3)
- I'd rather not answer (4)

Display This Question:

If Q18 = Convention Center/Exhibit Hall

Q34 What is the size of your convention center?

- ◯ Small (up to 100,000 square feet) (1)
- ◯ Medium (100,001 to 500,000 square feet) (2)
- ◯ Large (over 500,000 square feet) (3)
- ◯ I'd rather not answer (4)

Display This Question:

If Q18 = Other (please specify)

Or Q18 = I'd rather not answer

Or Q18 = Fairgrounds

Q35 What is the size of your public assembly venue?

- ◯ Small (1)
- ◯ Medium (2)
- ◯ Large (3)
- ◯ I'd rather not answer (4)

Q29 What is the age of your public assembly venue?

____

Q20 What type of market is your public assembly venue located in?

- Primary (1)
- Secondary (2)
- Tertiary (3)
- I'd rather not answer (4)

Q21 What IAVM Region is your public assembly venue located in?

- ◯ Region 1 (USA: CT, DC, DE, MA, MD, ME, NH, NJ, RI, VT, East NY and East PA. Canada: QC, NB, NS, NL, PE. All of Africa) (1)
- ◯ Region 2 (USA: IN, KY, OH, WV, West NY and West PA, Lower MI. Canada: Ontario minus Thunder Bay) (2)
- ◯ Region 3 (USA: IA, IL, MO, ND, NE, SD, MN, WI, Upper Peninsula of MI. Canada: Thunder Bay, ON) (3)
- ◯ Region 4 (USA: AK, ID, MT, OR, WA, WY. Canada: AB, BC, MB, NT, SK, YT) (4)
- ◯ Region 5 (USA: FL, GA, LA, MS, NC, SC, TN, VA. Central and South America) (5)
- ◯ Region 6 (USA: AR, CO, KS, NM, OK, TX. All of Mexico) (6)
- ◯ Region 7 (USA: AZ, CA, HI, NV, UT) (7)
- ◯ Region IAVM-VMA Asia/Pacific (Australia, New Zealand, New Guinea, Indonesia, Brunei, Singapore, Philippines, Kuala Lumpur, Burma, Thailand, Hong Kong, China, Laos, Vietnam, and Cambodia) (8)
- ◯ Other (please specify) (9) ____________________
- ◯ I'd rather not answer (10)

Q22 Is your public assembly venue?

- ○ University-based (1)
- ○ Non-university-based (2)
- ○ I'd rather not answer (3)

Q23 Which of the following choices best describes the ownership of your public assembly venue?

- ○ Public ownership (e.g., government) (1)
- ○ Private ownership (e.g, private/non-profit/other) (2)
- ○ I'd rather not answer (3)

Q24 Which of the following choices best describes the operation or management of your public assembly venue?

- ○ Public management (e.g., government) (1)
- ○ Private management (e.g., management company/non-profit/other) (2)
- ○ I'd rather not answer (3)

Q37 Do you make decisions regarding environmental sustainability and environmental impact in your venue?

- Yes (1)
- No (2)

Q25 Does your public assembly venue currently use environmentally sustainable practices?

- Yes (1)
- No (2)
- I'd rather not answer (3)

Q26 Does your public assembly venue currently track or assess environmentally performance?

- Yes (1)
- No (2)
- I'd rather not answer (3)

Q27 How important is it that your venue be environmentally sustainable?

- ○ Very important (1)
- ○ Somewhat important (2)
- ○ Neutral (3)
- ○ Somewhat unimportant (4)
- ○ Very unimportant (5)

Q28 Which of the following environmental sustainability certifications does your venue have (you may choose more than one)?

- ☐ LEED (1)
- ☐ Energy Star (2)
- ☐ City (3)
- ☐ State (4)
- ☐ ISO 14001 (5)
- ☐ Green Globes (6)
- ☐ Other (please specify) (7) ____________________

Q30 Where do you, as an employee of the public assembly venue, get information on environmental sustainability practices within the industry (you may choose more than one).

- ▢ Publications (e.g., Sport Business Journal) (1)
- ▢ Industry Conferences (e.g., IAVM VenueConnect Conference) (2)
- ▢ Non-profit organizations (e.g., Green Sports Alliance) (3)
- ▢ Other (please specify) (4) ____
- ▢ I do not get information on environmental sustainability (5)
- ▢ I'd rather not answer (6)

Q36 What is the name of your public assembly venue? (Remember: Your answers cannot be tied to you individually or the venue that you represent and the name of your venue will never be used in presentations or publications.)

- ○ Type name here: (1) ____
- ○ I'd rather not answer (2)

End of Block: Block 1
