

Environmental Impacts Management of the Coachella Valley Music and Arts Festival

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Abstract

The sustainability of music festivals is an urgent issue that must be discussed. Without careful consideration of environmental impacts, the short-term economic gain becomes a long-term fiasco. Coachella, the second-largest music festival in the US and the highest-grossing festival in the world, is possible to harm the environment. It provides pressure by bringing a hundred thousands of people at the same time and place. If the festival damages the environment, it will be costly and taking a long time to preserve the ecosystem. Therefore, it is crucial to assess the management of environmental impacts to recognise how a music festival could increase its environmental sustainability. The analysis ascertained qualitatively by using an approach of energy usage, waste generated, and transport emission produced (Fredline et al., 2005).

The result shows that much work has been done by Coachella organisers to reduce the environmental impact of the music festival they organised. First, the energy used in Coachella does not have too much impact on the environment because Coachella has applied sustainable energy framework. Next, in term of waste management, Coachella has been trying to minimise waste generated during the event by organising a massive waste sorting program. It can be said that the program has been quite successful at managing waste. Last, emissions produced from transport have the worst impact on the environment because it directly contributes to climate change. Furthermore, the organisers cannot control the number of vehicles used by attendees because this subject is at the preference of each attendee, and the organiser cannot fully control it.

Keywords: *Coachella, music festival, environmental impact, sustainable event*

1. Background

Over the decades, tourism has developed to be one of the fastest-growing industries in the world (UNWTO, 2018). One of the tourism sectors that influence this growth is events, especially music festivals (Getz, 1997). Music festivals have an impact on media interest increases, which will lead to the promotion of the music festival's location. It can be used to build destination branding and destination image globally (Boo and Busser, 2006). Moreover, it may become a tourism product which will attract visitor interest and increase the number of tourists (Bodwin, 2011). Accordingly, music

festivals have grown into a massive industry in the over past 25 years and became the centre of music culture around the world (Frith, 2007). The market for music festivals exploded in 2014. This is shown by an increase of more than 100% on the top-grossing events in the world (Rendon, 2018). There are approximately 110 music festivals in the US every year (Daisa and Breneman, 2017). With that number of music festivals, it is no wonder 32 million US citizens attended at least one music festival each year (Haider, 2019). The attendee's number may continue to grow in the future, which will inevitably harm the environment because it

provides pressure by bringing a hundred thousands of people at the same time and place (Gibson and Wong, 2011). If the event damages the environment, it can be costly and taking a long time to preserve the ecosystem, flora and fauna. Therefore, it is crucial to assess the environmental impacts to recognise how music festivals could increase their environmental sustainability.

In the 2000s, the awareness of the importance of sustainability, including music festivals, has been increasing (Scrucca et al., 2016). This makes comprehensible the research interest in the assessment on the environmental impacts of events (Mair and Jago, 2009) to maintain the event sustainability and to address climate change (Getz, 2010). Another thing that supports the urgency of conducting this study is that several music festivals are no longer organised because it harms the environment. One of the examples is T in the Park, a music festival in Scotland, which has been held since 1994. Because of the festival organised on the surface of an oil pipeline, had severe traffic issues, and had little awareness to recycling waste it cancelled for good (Forde, 2015 and T in the Park, 2016).

Even though several studies have been done, very little research has been conducted concerning the music festivals in the US. Most studies discuss music festivals in the UK and Australia (Glasset, 2014). Thus, this research uses Coachella Valley Music and Arts Festival (referred to here as Coachella) in California, the US, as the case study, with a descriptive approach. The descriptive approach is common in tourism research because of the changing nature of the phenomena being studied (Veal, 2006).

The objective of this research is to examine how adverse the environmental impact of a music festival is. Using a case study of Coachella, this study provides a critical analysis of the environmental impacts by calculating the carbon emissions of transport used by the festival (in this case by visitors only) and analysing the energy used and waste generated during the festival. It also examines whether the practice of sustainable event in Coachella succeeds or not and explored some recommendations to advance music festivals development.

2. Theoretical Framework

According to Getz (2010), in terms of tourism, an 'event' means a unique temporary phenomenon which is also an opportunity for leisure, social or cultural experience outside the normal range of choice or beyond every experience. It can be formed of specific rituals, presentations, performance or celebration that are consciously planned and created to mark special occasions to achieve particular social-cultural or corporate goals (Bodwin, 2006). 'Event tourism' is a term used mostly in the tourism literature to describe a destination development and marketing strategy to realise all the potential economic benefits of events (Getz, 2009). As event tourism, Coachella is an annual music festival which provides an opportunity for leisure and has the chance to improve economics and achieve particular social or cultural objectives.

Events are being developed as tourist attractions, and many are catalysts for development, or the renewal of a destination (Getz, 2009). The increase in local activity due to event tourism can, however, cause increased, potentially negative sustainability impacts – both environmental and social (Ferdinand, 2017). The increased activity and resulting impacts, if not managed well, could ultimately lead to the demise of what attracted people there in the first place, for example, over-development and destruction of the natural environment (Case, 2013). Thus, sustainable event concept should be applied in every event.

The definition of the sustainable event covers the economy and social culture and environment aspects (Getz, 2009). These include destination, site or venue, local environmental impacts, procurement/supply chain, waste, energy, transport, water and sanitation, workforce conditions and engagement and communication events (Jones, 2018). Fredline et al. (2004) also used these indicators to evaluate the environmental impact of an event, to be precise, the energy use, venue, water consumption and recycling, and waste generated and recycled. The focus of this research is the environmental impacts of the music festival, so aspects that explicitly discussed are energy, waste and transport.

First, sustainable energy management should be a priority for all venues and event managers. Looking for ways to run building more energy-

efficient and to provide efficient temporary power to events will bring about the twin benefits of cost-saving and reduced greenhouse gases (Jones, 2018). The need for energy causes fossil fuel extraction and combustion, which is contributing significantly to escalating GHGs, which in turn is affecting our climate to undeniable negative effect (Jones, 2018).

To measure how much is the impact of energy in an event or festival, the calculation of the greenhouse gas emission (GHG) that is released and its source from anywhere must be known. However, this analysis can be done qualitatively using the sustainable event management framework (Jones, 2018) by considering to stop fossil fuel addiction, reduce energy demand and change usage habits. The other framework is Measuring Events Through Environmental Research (METER) (Boggia et al., 2018) by considering several sub-categories for the assessment, which includes environmental certification (presence or absence); energy classification of the location; and energy consumption (percentage of electricity saved, share of energy used comes from renewable sources, percentage of heating fuels saved, and presence or absence of generators).

Another assessment procedure for measuring the environmental sustainability of events is based on several indicators, combined through a multi-criteria approach and aggregated into a final index, which is called METER (Boggia et al., 2018). The fundamental inputs for METER within the evaluation process are the participatory approach, based on the bottom-up model. Both the participatory approach and the multi-criteria analysis are approaches which, as far as we know, have been used for the time to evaluate event sustainability. Based on this index, energy consumption is crucial for event sustainability. In this case, the sub-categories considered for the assessment are environmental certification (presence or absence), which includes typically good practices for the use of energy; energy classification of the location; and energy consumption, which includes percentage of electricity saved, share of energy used comes from renewable sources, percentage of heating fuels saved, and presence or absence of generators.

Second, waste management at an event is also one of the critical issues, especially those organised to large numbers of attendees in a

fragile environment (Laing and Frost, 2010). If the organisers can restrict what the attendees are allowed to bring to the festival and can control the food and beverages sold and their packaging, they can influence the generation of waste and try to reduce it. Reducing the amount of waste generated at events is necessary because it reduces the negative environmental impact. However, as reducing will be difficult because the waste will continue to be generating every day, then the thing that needs to be done is recycling and reusing waste. In another way, it gives the waste materials a new life and possibly decreases the demand for raw materials. By recycling waste in an event, the organisers create opportunities for educating the attendees about what people can do to reduce their environmental impacts (Gellenbeck, 2018).

According to Jones (2018), more specific committees are needed during the event to apply sustainable management in waste management, such as recycling and composting coordinator, bin stewards, mobile compost stewards, vendor liaison staff, reclamation team and waste sorters, sponsor opportunities including producer responsibility for bottled beverages and bin audit and resource recovery accounting. Jones also mentions a detailed list of likely sustainably-related action items, such as: reviewing existing waste processes at venue/ site; options for off-site waste removal and processing; identifying likely waste streams, especially considering likely procurement and event activities; ensuring appropriate materials are used that match possible waste processes available locally; developing appropriate waste signage if not provided to ensure correct on-site segregation for effective disposal; inducting all staff into waste-management processes on-site; establishing waste figures collection procedures; and ensuring measurement. Based on the METER index that has been explained in the Energy section, above, waste management in an event should be done by separate collection. If not managed properly, an event can generate a large amount of waste, with adverse effects on the environment for the host territory (Hottle et al., 2015). The percentage of recycling for the waste category is considered as the individual detailed item. It is the separate collection percentage, compared to the total production of waste production throughout an event.

Last, travel and transport can be one of the most significant line items in an event's greenhouse gas emissions inventory, with attendee travel often being the most massive contributor to an event's GHG impact (Goldblatt, 2012). At events, there is a shared responsibility for travel-related impacts between event attendees, participants, suppliers and organisers (Case, 2013). It is a murky area, and regardless of who ultimately owns the impact, the impacts still occur (Jones, 2018). The cost of fuel, however, encourages efficiency by the supply chains, meaning reduced GHG intensity from the materials equipment and food supplied to the event.

Measuring how much GHG is produced at an event is essential for so many reasons. These include the responsibility to society to disclose the event's impacts, and through measurement to enable effective management (Case, 2013). There are wildly varying methods used in measuring the GHG inventories of events. One of them is by including the carbon footprint, by going into details and measuring the CO₂ emissions (Jones, 2018). The GHG Protocol is the most used tool to measure GHG in an event. The emission factors used in this tool come from the UK Department for Environment, Food and Rural Affairs (DEFRA), the US Environmental Protection Agency (EPA) and the Intergovernmental Panel on Climate Change's (IPCC) 2006 Guidelines for National Greenhouse Gas Inventories (Scrucca, Severi, Galvan and Brunori, 2016).

To measure GHG in an event, what kind of transportation is used for travel to the venue and its number must be known. Each type and size of vehicle has its carbon emission. Further, the average of the distance from the attendees' origin also must be known because the carbon emission produced is measured per mile. The final figure is given by multiplying this number of vehicles, and the mileage travelled with the carbon emissions produced by each vehicle per mile by the emission factors provided by DEFRA.

$$\text{Total emission (kg CO}_2\text{e)} = \text{number of vehicles} \times \text{distance (miles)} \times \text{emission per miles (kg CO}_2\text{e)}$$

After the measurement of energy, waste and travel experience that occurs in Coachella are

known, the next step is to analyse the management of the environmental impacts by using the concept of Environmental Management Plan (EMP). EMP should be prepared, which sets out the actions for monitoring and evaluation of events during implementation or construction and operation (Department of Environmental Affairs, 2014). This should form a fundamental part of the project specification. It includes mitigation measures to minimise adverse impacts, measure to enhance environmental benefits, identified risks and uncertainties, institutional support required for effective monitoring, environmental legislation and standards which apply and resources, funds, contractual and management arrangements (Fouracre, 2001). The objectives are to enhance the ecological benefits of the event, to consider the alternatives to the ideas that should be examined, and to identify any significant adverse environmental effects.

3. Research Method

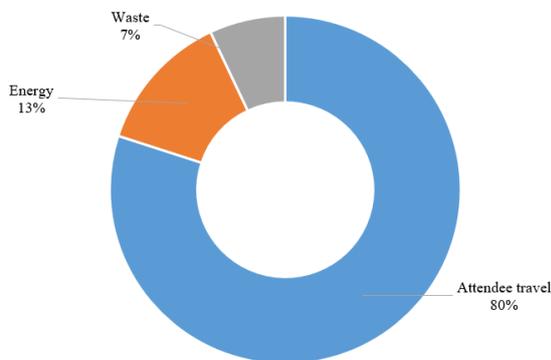
This study is qualitative research. The analysis of environmental impacts of a music festival can be ascertained qualitatively by using an approach of the energy use, transport, water consumption and recycling, and waste generated and recycle (Fredline et al., 2005). This study only used energy usage, waste generated, and transport emission produced to analyse the issue. The data used is secondary data which is taken from previously available material about music festivals, journal articles, books, event reports and governmental databases. After the data was collected, it then divided into several stages to be analysed. After knowing how much greenhouse gas emission is produced at Coachella, the last stage is to analyse how much influence it has on the environment and whether there are any efforts made to minimise it.

4. Research Findings and Discussion

A recent study of environmental impacts of music festivals shows that energy, waste and attendee's travel are the most significant greenhouse gas producers (Powerful Thinking, 2015). From the 100% average carbon emissions produced in music festivals, two-thirds or 80% are generated

by attendee travel, which does not include travel by staffs and artistes. It is then followed by energy, at 13%, and waste, at 7% (See Figure 1). These numbers may not be entirely reliable references to assess the level of environmental impacts of music festivals, in order to decide how to handle this impact properly. Accordingly, to understand how much the impact is on the environment, findings on energy usage, waste produced and transportation emission produced at Coachella are presented in this chapter. This includes the numbers and the organiser's effort to maintain sustainability at Coachella.

Figure 1. Average carbon emission of music festivals



Source: *Powerful Thinking*, 2015

4.1 The impact of energy used in Coachella

As a mega festival, which is the sixth-largest in the world, Coachella needs a massive amount of energy to run the event. The energy of a music festival is needed to include lighting, audio, video, bar, campsite and production offices (Marchini et al., 2013). If categorised based on function, the energy in a music festival is the need for the electricity that is stage-related, including audio, video, and lighting; trader-related, including food traders, non-food traders, bar; and site infrastructure-related, including production areas, tour buses performers, and parking areas. Unfortunately, it has not yet been established how much energy is used during Coachella and the sources of this energy. So, it cannot be measured how adverse effects of energy use in Coachella. However, quite a lot of data was found regarding the efforts of the organisers to make some attractions and playing areas to amuse the

attendees and to educate them about Coachella and how they support the sustainable event.

Nevertheless, Jones (2018) explains that the energy used at an event can be analysed qualitatively using the sustainable energy framework. In this case, Coachella is already trying to commit to reducing the negative impact on the environment, so they do exciting projects related to it. The purpose of doing the project is to make activities fun, but also to educate the attendees because they use renewable energy. Based on the projects that have been carried out, Coachella has implemented two out of three of the sustainable energy framework, which stops using fossil fuel and changes usage habits. This shows that Coachella has tried to make mitigation efforts to manage environmental impacts.

Since 2004, Coachella has collaborated with Global Inheritance to make the festival more environmentally friendly. The first collaboration related to energy was the Energy FACTory started in 2007. It is an interactive museum of energy-making that uses different instruments to highlight and educate the attendees about renewable energy resources. The Energy FACTory teaches the attendees of how wind, solar, thermal, bio-diesel, ethanol, kinetic energy, and other sources of energy can be used as alternative energy, without damaging the environment. Moreover, this platform makes the attendees participate and practice how to run environmentally friendly energy generators. For example, there are numbers of static bikes which can charge cell phones and make smoothies by

Figure 2. Energy Factory Human Hamster Wheels.



Source: *Paul*, 2011

pedalling them. Other examples include media which can power cell phones, camera and iPods at the same time as the attendees play with it. One of the exciting media of the Energy FACTory is the enormous human hamster wheel with the power to run DJ equipment and its sound systems, as can be seen in Figure 2. The energy comes from the kinetic energy of running inside the hamster wheel, which is converted into electricity. There are no plugins at all.

The second collaboration that was made is the Energy Playground, starting in 2010. It is an improved spin-off of the previous project they created. It consists of swings, seesaws, bikes, human hamster wheels and hand cranks. All of the kinetic energy is gathered into the lithium-ion battery command centre and stored in the Energy Well. It is monitorable as electricity flows from the production devices and the software made tracks all of the production aspects, including the results of attendees' work. It then can power snow cone machines, mixers, DJ sets and cell phone chargers. The Energy Playground shows the attendees of how much physical energy is required to power something. Further, it introduces the attendees to some alternative forms of energy while at the same time, realising the impact that they can make (Rysz, 2018). In 2012, a new exciting project was started by Global Inheritance. It was a 20-foot-tall replica of T-Rex, namely Recyclosaurus Rex. A giant robotic dinosaur was able to chew empty bottles and then crush them before they were recycled,

Figure 3. Attendee throws empty bottles to Recyclosaurus Rex



Source: Global Inheritance, 2013

as can be seen in Figure 3. It is powered from the Energy Well gathered at the Energy Playground. The attendees were able to feed it through its gaping mouth (Jessie, 2012).

Coachella also partnered with NRG Energy, a leading integrated power and energy company in the US. They committed to reducing 90% of Coachella's greenhouse gas emissions by making renewable energy-based and sustainable attractions. The biggest project they made was the instalment of 300 solar energy panels to power the festival.

Moreover, they used recycled containers to power the entire campsite area. Another project they made was another human hamster wheel which can power a mini-music festival. The difference with the one partnered with Global Inheritance was that NRG Energy recruited social influencers to tell stories about these sustainable projects through social media, such as Instagram and Facebook. They used the hashtags #CoachellaNRG and #CreatedWith to spread the message. They considered that the most effective way to influence millennials is by educating them about the importance of renewable energy through a fun experience in the main media they use daily. This project also aimed to be the ultimate draw for attending Coachella in the future (Whitehouse, 2015). Aside from investing solar energy at Coachella, NRG Energy also provided a cool-down station installed with a holographic 3D stereo experience. It was also powered with solar energy. The purpose was to entertain the attendees and introduce NRG Energy's sustainable services and projects to the younger generation.

The Energy Factor and Energy Playground provide several activities which show that entertainment at Coachella does not use fossil fuel to run the festival. By using solar and kinetic energy, DJ sets, phone chargers, mixers and snow cone machines can be enjoyed by the attendees. This shows that Coachella has tried to use renewable energy. The Coachella organisers did this because the production of CO₂e from fossil fuels in the US has been calculated as the most significant portion of emissions over the past five years, which is driven by the electric power sector (EPA, 2019). Moreover, to get fossil fuels, people must be mining and drilling to expose buried resources and extract the fuels to the surface. This process impacts the environment and human health (Holzman, 2011).

Given the fact that Coachella will continue to be held every year and the energy they need to conduct entertainment alone will be significant, the organisers tried not to use fossil fuels to reduce the negative impact on the environment. This also affects the attendees' concern for the environment.

By knowing that even the smallest amount of fossil fuel released can produce greenhouse emissions that can damage the earth, attendees are considering using renewable energy. Their involvement in riding a static bicycle to charge their phone and make juice, then run in a human-sized hamster ball to power the DJ equipment so they can enjoy the music, is a good thing because it means they are willing to contribute to reducing the greenhouse gas emission at Coachella. Although in reality, it will be difficult to apply to daily life or when travelling, with the attendees knowing that there are many things done related to reducing the use of fossil fuels, in the future, it will be easier to implement the use of renewable energy in everyday life. This is because 200,000 attendees have been educated about the dangers of the impact of energy on the environment (Global Inheritance, 2011).

Furthermore, Coachella has also tried to change usage habits. As is well known, since 2004, Coachella has been working with Global Inheritance to reduce the environmental impact of the events they hold. This collaboration will be carried out this year. This shows that the organiser is trying to maintain and positively increase their efforts to reduce energy use in the festival. Thus, it can be said that Coachella organisers and attendees are trying to change their habits to be more consistent in using renewable energy in the entertainment they provide.

Furthermore, green energy providers, like Global Inheritance, are progressively being active as sponsors, partners and exhibitors of some festivals so that they are able to recruit new customers (Getz, 2009). This is a symbiosis of mutualism for Coachella and Global Inheritance because it benefits both parties. Coachella benefits by no longer using fossil fuels as its energy source and Global Inheritance benefits from making Coachella introduce environmentally friendly products. Furthermore, according to EMP, this collaboration showed that Coachella had implemented institutional support for effective monitoring.

Assessed using the METER and EMP

framework (Boggia et al., 2018), it is unknown whether Coachella has an environmental certification or not, nor is it known whether the energy classification is high, medium or low, but it is known that the energy consumption is not too large. In detail, the environmental certification should include good practices for the use of energy in Coachella. If they have this certification, then Coachella can be said to have already implemented a sustainable energy framework proficiently. Unfortunately, no data was found whether Coachella has it or not. Therefore, it is also unknown whether the energy classification in Coachella is high, medium or low.

However, many international artists like Beyoncé, Ariana Grande, Guns N' Roses and AC/DC perform there, and they usually do so with a massive stage act, so the possibility of energy classification is high. Finally, with a large number of performers on the Coachella and the amount of entertainment provided by organisers, it can be said that the energy required is quite large. However, when talking about energy consumption, Coachella does not use too much power because they use renewable energy, so there may be some per cent of electricity saved from it. It is also known that Coachella is working with NRG Energy to invest in installing 300 solar energy panels to power the festival. This allows for the presence of generators in Coachella which is not usual in many music festivals.

4.2 The impact of waste generated in Coachella

Waste becomes a severe problem in almost every music festival all over the world. Hundred-Thousand or so people in the same location for several days will undoubtedly produce a high amount of litter. It is known that in 2017, 1,612 tons of solid waste was produced at Coachella. From this number, it is stated that only 20% can be recycled (Kennedy, 2017). This shows that waste might be an adverse impact. This will harm the environment, especially if the solid waste is mishandled. The decomposition of solid waste of improper handling will become environmental pollution because it is transformed into constituent chemicals (Ejaz et al., 2010). The chemicals will produce methane, which is a product of bacteria. These bacteria grow in the

landfill, where solid waste is dumped. Therefore, if Coachella's organisers do not handle the solid waste generated appropriately, it will threaten the groundwater systems and local surfaces, also contributing to the enhanced greenhouse gas effect and climate change (Goorah et al., 2009). If it is said that only 20% can be recycled, then the solid waste generated by Coachella is likely to have a direct negative impact on the environment, especially in the area of the final waste disposal site. However, Coachella has been trying very hard to limit the amount of waste during the event, especially waste that can be recycled. There are lots of waste of items left by attendees so that they can be donated to some places after clean up. Moreover, as Coachella partnered with Global Inheritance, they did projects to ease the recycling process after the festival finished and to minimise adverse impacts by mitigation actions.

The most highlighted project was TRASHed, introduced in 2004. TRASHed is an art and creativity program for painting and decorating trash bins to make them look attractive, as can see from Figure 4 below. Over 45 artists were invited and challenged to transform regular trash bins into masterpieces. It was then displayed at Coachella to encourage attendees to recycle. The trash bins have several functions: as aesthetic enhancers; as waste disposal; and also to encourage the attendees to sort the waste they are going to dispose of. Above the trash bins, there is information that shows whether the bin is for disposing of plastic, papers, cans, glass, or food waste (Jessie, 2012). This shows that Coachella has implemented the environmental legislation and waste separated standards which apply, as stated in the EMP concept. Coachella also has a designated staff group that help attendees to sort out waste if they are confused, as a form of institutional support required for effective monitoring. In addition to informing them regarding the classification of waste, this group also provides knowledge regarding waste, if there are attendees who ask why waste must be separated (Kennedy, 2010).

After the festival is over, the bins were donated to museums and schools. In 2019, the bins were donated to schools in Mexicali and Tijuana. It is also stated that not only artists can participate in transforming trash bins into art, but also schools

and members of the public. The participant needs to register directly with Coachella. Selected schools and individuals create their own designed trash bin that will be displayed at Coachella 2020. In exchange, they will also receive a collection of Coachella past bins and will be gifted with some merchandise care packages that teachers can incorporate into their curriculum to inspire students to go above and beyond their responsibilities to reduce their school's carbon footprint (Coachella, 2019).

Figure 4. TRASHed in Coachella



Source: Coachella, 2019

Another highlighted program of Coachella in managing waste is the Recycling Store, can see from Figure 5 below. It encourages the attendees to collect empty bottles and cans to trade in for free water or points which can be exchanged with merchandise and prizes, including Coachella tee-shirts, tote bags, refillable bottles, posters, sweatshirts, Ferris wheel tickets and even VIP upgrades. The mechanism of this trade is handing over ten bottles, known as 10-for-1 bottle exchange, to the staff. This method is beneficial to help collect empty bottles and cans that are scattered in the festival area. Since 2014, over 6 million recyclables have been saved. This program encouraged the attendees not to walk away from picking up scattered trash around them, and is expected to influence them when they are outside the festival. Furthermore, as mentioned in the energy usage section, Coachella has a programme named the Recyclosaurus Rex. This programme can be called a mitigation activity helps the recycling process and minimise the adverse impacts of waste. The attendees crush the plastic bottles, so it helps

speed the recycling process along (Coachella, 2019); Rysz, 2018; and Global Inheritance, 2015).

Figure 5. Attendees at the Recycle Store to exchange 10-for-1 Bottle



Source: Global Inheritance, 2010

Other waste, which is still in good condition, is donated to several charity centres. One of these is the Galilee Center, a charity combating poverty in California (Bostock, 2019). It provides shelter to those in need, includes migrant farmworkers. The donations from Coachella help them a lot. In April 2019, this charity centre received three truckloads of items which were donated and abandoned by the attendees. These include tents, sleeping bags, canopies, chairs, backpacks, clothes and even non-perishable food that had not been eaten (Hayden, 2019). Some of the items will be sold at the centre's thrift shop at low prices. The profit will be used as an addition to operating the shelter. This shows that Coachella made a significant effort to be sustainable and applies the management arrangements from the EMP concept.

The impact of events on the environment is lesser if the organisers apply a waste planning framework (Gellenbeck et al., 2018) a sustainable waste management framework (Jones, 2018) and the METER index on waste (Hottle et al., 2015). These include planning before, during and after the event, providing designated staff groups during the event and separate collection. Based on these three frameworks, Coachella has done most of the necessary preparation. Before the festival, Coachella creates a team consisting of recycling and composting coordinators, bin

stewards, mobile compost stewards, liaison vendor vendors, reclamation teams and waste sorters and sponsorship opportunities including producer responsibility for bottled beverages. These various designated staff groups have different tasks, such as determining which bins for waste will be provided at the venue, which artists will decorate and paint the bins, creating education boards to be installed on the bins (or the area around the bin) and deciding where the waste goes after the event is over. The result obtained from the designated staff groups is well-organised waste during the event, so it is infrequent to see garbage scattered in the venue. Also, with the bins being painted and decorated very attractively, attendees are motivated to separate the waste based on the categories given.

Another motivation for the attendees to not litter and help to pick up trash is because of a programme known as 10-for-1, where attendees can exchange ten empty plastic bottles with several gift options. This is efficient because otherwise, the staff have a hard time collecting many plastic bottles scattered at the festival venue. At the Glastonbury Festival in 2017, around 1,000 volunteers were needed to clean up the accumulated waste, and it took up to 4 weeks. Moreover, the organisers of the Glastonbury Festival also spent £785,000 on cleaning fees because of the accumulated waste that contaminated the land at the venue (Vonow, 2017). So, the 10-for-1 programme helps Coachella organisers a lot; also it is a win-win solution for assisting the organisers and attendees who get rewards and education related to the waste disposal in their place and sorted according to their respective categories.

4.3 The impact of transport emission to Coachella

It is known that as many as 36,502 vehicles were used to attendees to Coachella in 2016 (Meridian Consultants, 2016). This allows for adverse impacts on the environment. As shown in Table 1 below, the majority of vehicles used were cars, which were not only cars for personal use, but also cars for lift share (Carpoolchella) and in the form of public transportation such as taxis, Uber and PUDO, which are used for transfers to locations from airports, train stations and bus stations. The reason the attendees use their car is that it is more flexible and

effective, especially for attendees who are initially from the US or are travelling with family and carry lots of luggage to take. Although some admit that using their car will drain quite a lot of time and energy because traffic jams often occur, attendees state that using their car is very practical. If each car can accommodate four people, the number of attendees who use a car is 146,012 or 73.74% of the total attendees in 2016, which is 198,000. This figure exceeds the average number of attendees in the UK who use cars, which is only 16% of the total attendees (Powerful Thinking, 2017). Thus, around 51,988 attendees use transportation other than cars, such as trains and buses. The number of attendees who walked or used bicycles was not included as well because the number is still tiny.

Table 1. Amount of vehicles used to reach Coachella in 2016

Type of vehicles	Amount
Day parking	12,506
Shuttle	n/a
Uber/Taxi/PUDO	3,485
Walk/Bike	n/a
Car camping	13,412
Tent camping	569
Companion camping	1,290
Staff vehicle	5,242
Total amount	36,502

Source: Meridian Consultants, 2016

Based on the amount of vehicle used to reach Coachella in 2016, it is known that car camping has the most significant number, which is 13,412 cars. This shows that most attendees are comfortable to drive their car and take it for camping at Coachella. These cars that have been parked in the car camping area are rarely taken out, because it is quite complicated to get out of the camping spots that have been arranged in such a way as to maximise space, and then park again and re-arrange them. This is in contrast to day parking. The 12,506 cars used to travel to Coachella can only be parked during the festival and must exit the parking area at night until the next day when the parking area has reopened.

Thus, the attendees who have a day parking pass must find a parking space and a place to stay outside the venue, which can be quite far away. This also affects the increase in the number of greenhouse gas emissions produced because many cars have to be driven several times during the 3-6 days of the event. Likewise, with Uber/ Taxi/ PUDO, these vehicles also have the potential to increase the amount of carbon emission because they continue to be ordered by the attendees to reach the venue and place where they live because the attendees do not have access to camping at Coachella. There are also the committee vehicles, which of course will often be used to meet the needs for the running of the festival.

Table 2. Origin of attendees in 2016

Origin	Percentage
Local	4%
Region	52%
State-wide Area	16%
US	16.50%
International	11.50%
	100%

Source: Meridian Consultants, 2016

As can be seen in Table 2 above, of the total 100% attendees of Coachella, those coming from California Region ranked first place, at 52%. The Region includes Los Angeles, San Diego, San Jose, San Francisco, Fresno, and Sacramento. The second biggest origin is from the US as a whole, with a percentage of 16.5%. It followed with attendees who come from state-wide areas, at 16%; international, at 11.50%; and the local attendees, at 4%. By knowing where attendees to Coachella came from, the difference between the departure location of attendees to Coachella will also be recognised. This will then be used to calculate how much greenhouse gas emissions are produced at Coachella through the transportation used by attendees. As explained in the literature review, calculating how much greenhouse gas emission is generated by vehicles is by multiplying the number of vehicles with the distance travelled and the carbon emissions produced by each vehicle per mile.

Based on the report, it can also be stated that each of the attendees' origin includes three different distances, with its percentages, except those originating from the local area. As can be seen in Table 3 below, the percentage of attendees whose origin is from the California Region is 52%. Of that percentage, 10% come from areas with a distance of 60 miles, 45% come from areas with a distance of 120 miles, and 45% come from areas with a distance of 180 miles. Attendees originating from State-wide Areas, the whole US and international areas, have almost the same ratio between percentage and distance. 30% of each category come from areas with a distance of 22 miles, 35% come from areas with a distance of 90 miles, and 35% come from areas with a distance of 145 miles.

Table 3. Distance and percentage of attendees from each origin in 2016

Origin	The percentage of total origin	Distance (miles)	The percentage from each origin
Local	4%	22	
Region	52%	60	10%
		120	45%
		180	45%
State-wide Area	16%	22	30%
		90	35%
		145	35%
US	16.5%	22	30%
		90	35%
		145	35%
International	11.5%	22	30%
		90	35%
		145	35%

Source: Meridian Consultants, 2016

Furthermore, to do the calculation, it is necessary to know how much carbon emission is

produced by each vehicle per mile and how adverse is the impact of transportation. However, due to the limited data related to the amount of emission produced by a vehicle per mile in the USA, the calculation of greenhouse gas emission is carried out using the UK Government GHG Conversion Factors (2018). The scope of the factors is defined such that it is relevant to emission calculation. Based on the conversion factor, it is known that the vehicles in each type have the same greenhouse gas emissions, excepting walk/ bike. This is due to the similar size of the vehicle, which is the average car. The amount of emission is 0.28572 kg CO₂e per mile (Department of Business, Energy & Industrial Strategy, 2018). Calculations on the shuttle and walk/ bike cannot be done because there are no known numbers.

The calculation of total emission was done by multiplying the numbers of how many vehicles are used to travel to Coachella, how many miles are the distance, and how much emission is issued per mile. All vehicles were calculated except for shuttle and walk/ bike because there is no recorded number. Table 4 below is the result of the total calculation of each vehicle used to travel to Coachella.

Table 4. Total emissions of all vehicles to Coachella

Type of vehicles	Total emissions (kg CO ₂ e)
Day parking	405,041
Uber/Taxi/PUDO	112,811
Car camping	434,151
Tent camping	18,418.7
Companion camping	41,757.8
Staff vehicle	169,685
Grand total	1,181,864.50

Source: Adapted from Meridian Consultants (2016) and Department of Business, Energy & Industrial Strategy of the UK (2018)

The total greenhouse gas emissions are 1,181,864.50 kg CO₂e, equivalent to 1,182 metric tons of CO₂e. This figure is equal to 251 average passenger vehicles driven for one year or 2,889,644 miles (Environmental Protection Agency, 2019). The number is also equivalent to 142 homes' energy

use for one year and 206 homes' electricity use for one year. So it can be said that greenhouse gas emission from transportation is high. However, when compared to the average emissions of a large music festival in the United Kingdom, Coachella's emissions number is slightly lower. Emissions produced at music festivals in the United Kingdom are 1,731 metric tons of CO₂e, including cars, train and coach travels, logistics trucks and tour buses (Bottrill et al., 2007). Even though this number is higher, compared to Coachella, which does not include logistic trucks and tour buses, the emissions produced in Coachella may be higher. Moreover, the figure does not include aeroplanes, trains and buses used by attendees to reach locations. If added to the carbon emission produced by attendees using aeroplanes, buses and trains, the number will be higher, and the impact on the environment will be even worse.

According to Rodrigue (2017), the direct impact on the environment that can be felt is from noise and carbon monoxide emissions. Next, the indirect impact of transportation is linked to respiratory and cardiovascular problems. Lastly, the most dangerous is the cumulative impacts, which is the contribution to climate change. 22% of global CO₂ emissions are attributed to transportation. In the US, the use of transportation contributes almost 30% of all global warming emissions, rivalling the power sector (Energy Information Administration, 2016). For example, this will lead to floods due to rising sea levels, smog, acid rain, and decreased air quality due to climate change (DEFRA, 2010).

Nonetheless, having hundreds of thousands of cars in Coachella, and music festivals, in general, cannot be avoided. So the efforts and mitigations that can be done by the organisers are to give rewards to attendees who are willing to provide a ride to other attendees, if the car they drive is not yet full, through the Carpoolchella program (See Figure 6). This shows that Coachella has identified the risks and uncertainties of the impacts of transportation. Also, the organiser tried to do institutional support with the attendees for effective monitoring. Thus, this programme is carried out to maximise the existing space in the car so that carbon footprint is shared with more people. The rules are the cars should be filled with minimum four, and there should be a sign for Carpoolchella so that people

who wanted to take a ride would easily recognise it. The attendees are also encouraged to decorate the car to make it look attractive, as can see from Figure 6. Attendees participating in this project will get the chance to win prizes such as Coachella Passes for life VIPs, guest backstage passes, VIP pass upgrades, \$50 Coachella merchandise vouchers, Ferris wheel vouchers and \$20 food vouchers (Global Inheritance, 2015).

Figure 6. Carpoolchella



Source: Coachella, 2019

One of the best examples of good practice of transportation is the Glastonbury Festival, where bus package tickets are available in several cities in the UK. Ticket packages by bus are available from as far away as Scotland (over 360 miles to the border) (Glastonbury Festival, 2018). Thus, it is possible if Coachella's organiser also makes the same package because, in 2016, the attendees came from the California Region dominated with 52% [See Table 2]. For example, the organiser can sell bus ticket packages from Los Angeles and San Diego, which are only 130 miles away from the venue. Glastonbury's bus package tickets are sold earlier than the event only ticket. This encourages attendees to use public transportation to reach the festival venue. Glastonbury Festival is the biggest and most popular music festival in the UK. Thus this package ticket runs out in less than 30 minutes after sales begin (Heal, 2018).

If the organiser can provide more buses, the number of attendees who use private vehicles, such as cars, will be reduced, which will directly reduce greenhouse gas emissions as well. This view was supported by a research conducted by A Greener Festival and Buckinghamshire New University,

which stated that 74% of people who joined the survey were willing to take public transportation to reach a festival venue, especially if the organiser included the travel cost in the festival ticket. This makes it easier for the attendees to reach the site with less greenhouse gas emissions (A Greener Festival, 2008). Thus, encouraging the attendees to use public transportation and car-sharing will help reduce the carbon footprint. However, this subject is at the preference of each attendee, and the organiser cannot fully control it.

5. Conclusion

Music festivals have become one of the areas within the tourism sectors that are proliferating. However, bringing many people to festival venues will inevitably harm the environment around it. Consequently, assessing the environmental impacts of festivals are essential, to find out how adverse these impacts are. Coachella was chosen as a case study because very few studies have been conducted regarding music festivals in the US. However, the data found is quite limited, which leads to the limitation of this study.

The findings show that much work has been done by Coachella organisers to reduce the environmental impact of the event they organise. They have taken mitigation measures to minimise adverse impacts, measures to enhance environmental benefits, identified risks and uncertainties, done some institutional support for monitoring and implementing environmental legislation and standards as part of the Environmental Management Plan concept.

The energy used in Coachella does not have too much of an adverse impact on the environment. This is because the entertainment that they hold is generated through renewable energy, such as from solar energy and kinetic energy. By not using fossil fuels and involving attendees to power the festival, Coachella has applied sustainable energy framework.

Solid waste produced at Coachella is quite high, and only a few of it can be recycled. This does harm the environment. However, in the most recent years, Coachella has been trying to minimise the waste generated by organising a massive waste sorting program, so it is easy to recycle and reuse

after the event. Moreover, they donated items left by the attendees, which are still feasible to use. It can be said that Coachella has been quite successful at managing waste so that the impact on the environment is not too high.

Emissions emitted from transportation have the worst impact on the environment. This is because the organisers cannot control the number of vehicles used by attendees. The only thing that they can do is give rewards to attendees who are willing to provide a ride to other attendees if the car is not full. Carbon emission produced from transportation has a significant impact on the environment because it directly contributes to climate change and decreased air quality. The greenhouse gas produced is quite large, even though it does not include GHG from several other vehicles such as coaches, trains and aeroplanes.

To sum up, the running of Coachella every year gives an adverse impact on the environment. Based on the results of the analysis carried out, the most significant impact on the environment comes from emissions produced from transportation, then followed by waste generated and energy usage. However, because the event will continue to be held every year, the organisers will look to improve existing programs to reduce the impact on the environment, as part of mitigation action and developing new campaigns to connect with the wider attendee (Global Inheritance, 2015). Practically, there is a need for the organisers to continuously innovate in renewable energy and encourage the attendees to dispose of garbage in the bin, according to their respective categories, and encourage them to use public transportation instead of private cars. Moreover, this can be supported by the provision of event tickets, which include transportation tickets from several cities in the US because attendees who use the most cars are those who live in the US. Furthermore, it is crucial to encourage every organiser to make the environmental report of their music festival accessible to the public, so that many people are aware of the ecological impacts. Academically, further research is required to critically examine the environmental impact of music festivals in the US. A critical and detailed study on the environmental impact of the music festival has become an essential foundation for developing sustainable events.

References

- A Greener Festival. (2008). *A Survey of What Music Fans Think of Green Issues at Live Music Events. Research by Buckinghamshire New University for A Greener Festival*. [Online] Available at: <http://www.agreenerfestival.com/newsletters/Music%20Fans%20Want%20Green%20Events.pdf> [Accessed 26th May 2019].
- Becken, S., Simmons, D. G., and Frampton, C. (2003). Energy use associated with different travel choices. *Tourism Management*, 24, 267-277.
- Boggia, A., Massei, G., Paolotti, L. Rocchi, L. and Schiavi, F. (2018). A model for measuring the environmental sustainability of events. *Journal of Environmental Management*, 206, 836-845. <https://doi.org/10.1016/j.jenvman.2017.11.057>
- Boo, S. and Busser, J. A. (2006). Impact Analysis of a Tourism Festival on Tourist's Destination Images and Satisfaction. *Event Management*, 9, 165-181. <https://doi.org/10.3727/152599506776771562>
- Bostock, B. (2019). *Glastonbury and Coachella are the 2 most famous music festivals in the world – here's how they compare*. [Online] Available at: <https://www.insider.com/glastonbury-and-coachella-in-photos-which-festival-is-better-2019-7> [Accessed 16th June 2019].
- Bottrill, C., Lye, G., Boykoff, M. and Liverman, D. (2007). *UK Music Industry Greenhouse Gas Emissions for 2007*. Oxford: Oxford University-Environmental Change Institute.
- Bowdin, G., Allen, J., O'Toole, W., Harris, R. and McDonnell, I. (2011). *Event Management*. Oxford: Butterworth-Heinemann.
- Case, R. (2013). *Events and The Environment*. New York: Routledge.
- Coachella. 2019. *Art of Recycling – Trashed*. [Online] Available at: <https://www.coachella.com/sustainability/> [Accessed 18th June 2019].
- Daisa, A. and Breneman, B. (2017). *FESTatistics: Festivals by The Numbers*. [Online] Available at: <http://www.festforums.com/new-blog-1/2017/5/31/festatistics-festivals-by-the-numbers> [Accessed 5th May 2019].
- DEFRA. (2010). *Air Pollution: Action in Changing Climate*. London: Department for Environment, Food and Rural Affairs.
- Departement of Environmental Affairs. (2014). *Environmental Impact Assessment and Management for South Africa*. Pretoria: Departement of Environment Affairs and Tourism (DEAT).
- Ejaz, N., Akhtar, N., Nisar, H. and Naem, U. A. (2010). Environmental impacts of improper solid waste management in developing countries: a case study of Rawalpindi City. *WIT Transactions on Ecology and the Environment*, 142, 379-387.
- Energy Information Administration (EIA). (2016). *Monthly energy review*. Washington DC: US Department of Energy. [Online] Available at: <http://www.eia.gov/totalenergy/data/monthly/> [Accessed 16th July 2019].
- Environmental Protection Agency (EPA). (2019). *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2017*. Washington DC: Environmental Protection Agency (EPA).
- Ferdinand, N. (2017). *Events Management: An International Approach*. Los Angeles: SAGE Publication.
- Forde, E. (2015). *The cost of staging a music festival: 'We spent £30,000 on the waste'*. [Online] Available at: <https://www.theguardian.com/music/2015/jul/09/cost-of-staging-music-festival> [Accessed 23rd August 2019].
- Fouracre, P. (2011). *Environmental Impact Assessment and Management*. [Online] Available at: https://www.ssatp.org/sites/ssatp/files/publications/HTML/rural_transport/knowledge_base/English/Module%205/5_4a%20Environmental%20Impact%20Assessment.pdf [Accessed 3rd November 2019].
- Fredline, L., Raybould, M., Jago, L. and Deery, M. (2005). Triple Bottom Line Event Evaluation: A proposed framework for holistic event evaluation. In *Proceedings of International Event Research Conference 2005*. Lindfield: Australian Centre for Event Management.
- Frith, S. (2007). Live music matters'. *Scottish Music Review*, 1, 1-17.
- Gellenbeck, T., Hoyt, S., Lubenow, C. and Tack, H. (2018). *How to Incorporate Recycling & Composting into Your Special Event*. Arizona: Arizona Recycling Coalition.
- Getz, D. (2010). The nature and scope of festival studies. *International Journal of Event Management Research*, 5, 1-47.
- Getz, D. (2009). Policy for sustainable and responsible festivals and events: institutionalization of a new paradigm. *Journal of Policy Research in Tourism, Leisure and Events*, 1, 61-78. <https://doi.org/10.1080/19407960802703524>
- Getz, D. (1997). *Event management and event tourism*. New York: Cognizant Communication Corp.
- Gibson, C. R. and Wong, C. (2011). Greening Rural Festivals: Ecology, Sustainability and Human-Nature Relations. In C. R. Gibson & J. Connell (Eds.). *Festival Places - Revitalising Rural Australia*, 92-105. Bristol: Channel View

- Publications.
- Glasnet, M. (2014). Greening The Festival Industry: Using the Triple Bottom Line Approach to Promote Sustainability in Music Events. *Undergraduate Honors Theses*. Boulder: University of Colorado.
- Glastonbury Festival. (2018). *Glastonbury ticket info*. [Online] Available at: <https://www.glastonburyfestivals.co.uk/information/tickets/> [Accessed 26th July 2019].
- Global Inheritance. (2015). *Recycling*. [Online] Available at: <https://www.globalinheritance.org/programs/recycling> [Accessed 20th June 2019].
- Global Inheritance. (2011). *Programs Energy FACTory*. [Online] Available at: <http://archive.globalinheritance.org/programs/read/14/energy-factory> [Accessed 13th July 2019].
- Global Inheritance. (2010). *Coachella 10for1*. [Online] Available at: <https://hiveminer.com/Tags/coachella%2Crecycle> [Accessed 18th July 2019].
- Goldblatt, S. D. (2012). *The complete guide to greener meetings and events*. New Jersey: John Wiley & Sons, Inc.
- Goorah, S., Esmyot, M. L. I. and Boojhawon, R. (2009). The health impact of non-hazardous solid waste disposal in a community: the case of the Mare Chicose landfill in Mauritius. *Journal of Environmental Health*, 72, 48-54.
- Gossling, S. (2002). Human-environmental relations with tourism. *Annals of Tourism Research*, 29, 539-556.
- Haider, A. (2019). *From Woodstock to Coachella: The ultimate music festivals*. [Online] Available at: <http://www.bbc.com/culture/story/20190405-from-woodstock-to-coachella-the-ultimate-lost-weekends> [Accessed 5th May 2019].
- Hayden, N. (2019). *Galilee Center received 3 trucks filled with donations from Coachella festival*. [Online] Available at: <https://eu.desertsun.com/story/news/2019/04/19/coachella-fest-donates-3-truck-loads-galilee-center/3525943002/> [Accessed 15th June 2019].
- Heal, A. (2018). *Glastonbury tickets for 2019 sell out in half an hour*. [Online] Available at: <https://www.theguardian.com/music/2018/oct/07/glastonbury-tickets-2019-sell-out-in-half-an-hour> [Accessed 9th July 2019].
- Holzman, D. C. (2011). Mountaintop removal mining: Digging into community health concern. *Environmental Health Perspectives*, 119, A476-A483. <https://doi:10.1289/ehp.119-a47>
- Hottle, T. A., Bilec, M. M., Brown, N. R. and Landis, A. E. (2015). Toward zero waste: composting and recycling for sustainable venue based events. *Waste Management*. 38, 86-94. <https://doi.org/10.1016/j.wasman.2015.01.019>
- Jessie. 2012. *Earth Day and Coachella; How 'Green' is This Festival?* [Online] Available at: <https://www.pollstar.com/News/coachella-is-once-again-the-highest-grossing-festival-in-the-world-134155> [Accessed 15th June 2019].
- Jones, M. (2018). *Sustainable Event Management: A Practical Guide*. New York: Routledge.
- Kennedy, C. S. (2017). *Coachella generates 107 tons of solid waste each day. About 20% of it gets recycled*. [Online] Available at: <https://eu.desertsun.com/story/life/entertainment/music/coachella/2017/04/21/coachella-generates-107-tons-solid-waste-each-day-20-gets-recycled/305682001/> [Accessed 12th June 2019].
- Laing, J. and Frost, W. (2010). How green was my festival: Exploring challenges and opportunities associated with staging green events. *International Journal of Hospitality Management*. 29, 261-267. <https://doi.org/10.1016/j.ijhm.2009.10.009>
- Lazarte, R. (2014). *Music to Our Ears: Outdoor Festivals Turn Energy Efficiency Way Up*. [Online] Available at: <https://www.ase.org/blog/music-our-ears-outdoor-festivals-turn-energy-efficiency-way> [Accessed 12th May 2019].
- Mair, J. (2018). *The Routledge Handbook of Festival*. New York: Routledge.
- Mair, J. and Jago, L. K. (2009). *Business events and climate change. A scoping study*. Melbourne: Centre for Tourism and Service Research Victoria University.
- Marchini, B., Fleming, P. and Maughan, C. (2013). *Reducing Electricity Related Greenhouse Gas Emissions at Music Festivals*. [Online] Available at: <http://www.powerful-thinking.org.uk/site/wp-content/uploads/Electricity-at-Festivals-summary-findings-March-2013.pdf> [Accessed 10th July 2019].
- Meridian Consultants. (2016). *Addendum to the Final Environmental Impact Report for the Music Festival Plan*. California: Meridian Consultants.
- Paul, R. (2011). *Coachella's Human Powered DJ Booth Blasts Renewable Blips and Bleeps*. [Online] Available at: <https://inhabitat.com/coachellas-human-powered-dj-booth-blasts-renewable-blips-and-bleeps/hamsterwheel2> [Accessed 19th June 2019].
- Pittman, S. (2018). *Coachella is Once Again the Highest Grossing Festival in the World*. [Online] Available at: <https://www.pollstar.com/News/coachella-is-once-again-the-highest-grossing-festival-in-the-world-134155> [Accessed 5th May 2019].
- Powerful Thinking. (2015). *The Show Must Go On Report*. [Online] Available at: <http://www.>

- powerful-thinking.org.uk/site/wp-content/uploads/TheShowMustGoOnReport18..3.16.pdf [Accessed 8th June 2019].
- Rendon, F. (2018). *Looking at The Growth of Festivals Through Pollstar's Charts*. [Online] Available at: <https://www.pollstar.com/News/looking-at-the-growth-of-festivals-through-pollstars-charts-134941> [Accessed 4th May 2019].
- Richter, F. (2019). *The Largest Music Festival in the World*. [Online] Available at: <https://www.statista.com/chart/17757/total-attendance-of-music-festivals/> [Accessed 5th May 2019].
- Rodrigue, J. (2017). *The Geography of Transport Systems*. New York: Routledge.
- Rysz, A. (2018). *Festival Fun at Coachella Without Costing Mother Earth*. [Online] Available at: <http://www.refinedtravellers.com/festival-fun-at-coachella-without-costing-mother-earth/> [Accessed 12th June 2019].
- Scrucca, F., Severi, C., Galvan, N. and Brunori, A. (2016). A new method to assess the sustainability performance of events: Application to the 2014 World Orienteering Championship. *Environmental Impact Assessment Review*, 56, 1-11. <http://dx.doi.org/10.1016/j.eiar.2015.08.002>
- T in the Park. (2016). *Thank you*. [Online] Available at: <http://www.tinthepark.com/> [Accessed 23rd August 2019].
- UNWTO. (2018). *UNWTO Tourism Highlights, 2018 Edition*. UNWTO.
- Veal, A. J. (2006). *Research Methods for Leisure and Tourism: A Practical Guide*. Harlow, United Kingdom: Pearson Education.
- Vonow, B. (2017). *Glastonbury clean-up costing £785,000 and lasting six weeks begins as 200,00 festival-goers head home leaving behind mounds of rubbish*. [Online] Available at: <https://www.thesun.co.uk/news/3883718/glastonbury-2017-clean-up-pictures-rubbish-after-festival/> [Accessed 20th June 2019].
- Waite, G. (2008). Urban festivals: geographies of hype, helplessness and hope. *Geography Compass*, 2(2): 513–537.
- Whitehouse, L. (2015). *Carbon-chella*. [Online] Available at: <https://lwhiteh2.wordpress.com/2015/05/02/carbon-chella/> [Accessed 13th June 2019].
- Brommer, B., Sidharta, A., Budihardjo, E., Siswanto, A., Montens, A. B., Soewarno, S. S., & Stevens, T. 1995. *Semarang, Beeld van een stad*. Nederland: Asia Major.
- Byrne, D., Brayshaw, H. and Ireland, T. 2003. *Social significance: a discussion paper*. New South Wales: National Parks and Wildlife Service.
- Gadamer, Hans Georg. 1996. *Truth and Method (2nd rev. ed., Joel Weinsheimer & Donald Marshall, Trans.)*. New York: Continuum.
- Hall, S. 1997. "The Work of Representation" in Stuart Hall (Ed.) *Representation: Cultural representations and signifying practices Vol. 2*. London: Sage Publications, pp. 13-74.
- Hodder, Ian. 1998. "The past as passion and play Catalhoyuk as a site of conflict in the construction of multiple pasts" in Lynn Meskell (Ed.) *Archaeology Under Fire: Nationalism, Politics and Heritage in the Eastern Mediterranean and Middle East*. London: Routledge, pp. 124-139.
- Kelly, Catherine. 2009. "Heritage" in Thrift, Nigel and Kitchin, Rob, (Eds.) *The International Encyclopedia of Human Geography*. London: Elsevier, pp. 91-97.
- Kinsella, E. A. 2006. "Hermeneutics and and Critical Hermeneutics: Exploring Possibilities Within the Art of Interpretation" in *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research Vol. 7. No. 3*, pp. 13-20.
- Klinkhamer & Ouendag. 1916. "Het Administratiegebouw der Nederlandsch-Indische Spoorweg Maatschappij te Semarang". *Nederlands-Indie Oud en Nieuw vol 1, Issue 1*. pp. 23-31.
- Marshall, C., & Rossman, G.B. 2014. *Designing Qualitative Research*. Sage Publications.
- Mason, R. 2002. "Assessing Values in Conservation Planning: Methodological Issues and Choices" in Marta de la Torre (Ed.) *Assessing the Values of Cultural Heritage*. California: The Getty Conservation Institutem, pp.5-49.
- Miles, M. B., Huberman, A. M., & Saldana, J. 2013. *Qualitative data analysis*. Sage Publications.
- Nuryanti, W. 1996. "Heritage and Postmodern Tourism". *Annals of Tourism Research*, 23(2), pp.249-260.
- Odman, P.J. 1988. "Hermeneutics" in John P Keeves in *Educational research methodology and measurement: An international handbook*. New York: Pergamon Press, pp. 63-70.
- Puczkó, L.A.S.Z.L.O. 2006. "Interpretation in cultural tourism" in Smith, M. & Robinson, M (ed.) *Cultural Tourism in a Changing World: Politics, Participation and (re) presentation*. Bristol: Channel View Publications, pp.227-244.
- Rátz, T. 2006. "Interpretation in the house of terror, Budapest" in Smith, M. & Robinson, M (ed.) *Cultural tourism in a changing world: Politics, participation and (re) presentation*. Bristol: Channel View Publications, pp.244-56.
- Shanks, M., & Tilley, C. Y. 1992. *Re-constructing archaeology: theory and practice*. London: Routledge.

- Sudarmadi, T. 2014. Between colonial legacies and grassroots movements: exploring cultural heritage practice in the Ngadha and Manggarai Region of Flores. *Dissertation*, Vrije Univeristy Amsterdam.
- Throsby, D. 1999. Cultural capital. *Journal of cultural economics*, 23(1-2), pp.3-12.
- Vecco, M. 2010. A definition of cultural heritage: From the tangible to the intangible. *Journal of Cultural Heritage*, 11(3), pp.321-332.
- Wright, A.C. and Lennon, J.J. 2007. Selective interpretation and eclectic human heritage in Lithuania. *Tourism Management*, 28(2), pp.519-529.