Methods and Tools for Sustainable Festivals

Towards Effective and Future-Oriented Environmental Sustainability Assessment Methods for the Dutch Festival Sector

Dekmantel Festival 2022, own photograph

LarsLensink
5553393
l.j.lensink@students.uu.nl

Copernicus Institute of Sustainable Development
Utrecht University
Master *Sustainable Development*
Track *Energy & Materials*

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Thesis supervisor: Arturo Castillo Castillo
Internship supervisor: Tijl Couzij, LAB Vlieland

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Preface

Dear reader,

Before you lay the product of a research project for which the first seeds were planted more than 1,5 years ago. I remember well the moment I had a conversation with a fellow volunteer at a festival where we were both working, when he asked me why I did not combine my passion for music festivals and sustainability. This made me think. And now, here I am, (hopefully) graduating with research on environmental sustainability in the festival sector.

I'm currently a Master's student in Sustainable Development at Utrecht University, focusing on the 'Energy & Materials' track. My academic roots are in Information Sciences, where I wrote my Bachelor's thesis on social impact assessment methods and tools for social enterprises. This technical background has definitely shaped how I approach sustainability, and it's been a core part of this present research project too.

My interest in sustainability sparked during a gap year when I worked installing solar panels. That experience opened my eyes to the importance of sustainability, leading me to dive deeper into the subject through a Minor and ultimately ending up in this Master's in Sustainable Development.

The search for a thesis topic brought me to Lab Vlieland. During my first meeting with Tijl Couzij, who later became my internship supervisor, I quickly realised that the things he was working on with Lab Vlieland, Into The Great Wide Open Festival, and the Green Deal Circular Festivals aligned perfectly with my interests. It felt like a match made in heaven.

I hope this study and its findings can be of value for anyone interested in festival sustainability and monitoring tools as I provide recommendations directed at festival organisers, governments and regulators, and tool developers. However, I believe that this study provides an interesting look behind the scenes of the festival sector and how it is addressing the major environmental challenges of today. I hope my thesis provides an interesting read for any curious mind.

I want to extend a big thanks to those who have supported me throughout this journey. First of all, to my supervisor at the faculty, Arturo Castillo Castillo. Your comments and feedback were always very thoughtful and constructive. The advice you gave me often carried on way beyond the scope of this research project alone. I am sure I will often think back to this formative time, which would have been much less educational without your supervision.

To Tijl Couzij, thank you for the several hours-long discussions and conversations. These were always very insightful. I am thankful for the opportunity you gave me with this internship and

the trust you placed in me. Claudia Walraven, I am glad I decided to approach you at ESNS earlier this year. You have become a good friend, and I value your mentorship a lot. Without you, I am not sure if all my participants would have been so eager to get involved with my research. Thanks for the good times at the office, Daan Stigter and Jonna van Lierop, see you on Vlieland!

Most importantly, I'm incredibly thankful for my temporary thesis-quarantine housemates: mom and dad. Thank you so, so much for all the love and care, the practical and mental support, and most of all, the endless patience I required from you. I think this thesis project has almost caused you more sleepless nights than it did for me. Rest assured; I will never do this again.

Of course, lastly, I need to thank the one volunteer at Grasnapolsky Festival who is an essential part of the reason that you are now reading this report. I must admit I have forgotten your name, but the conversation we had that day is a core memory now.

Lars Lensink
August 5th, 2024

Abstract

This study investigates how to safeguard the effectiveness and future orientation of monitoring tools for the environmental sustainability of festivals. Through a comprehensive analysis of existing tools, stakeholder interviews, and case studies of industry frontrunners, the research identifies key gaps, barriers, and best practices, culminating in actionable recommendations for the festival sector.

The findings reveal that current tools for assessing environmental impacts are often fragmented and lack comprehensiveness. They fail to cover the full spectrum of festival activities and environmental impacts, leading to incomplete sustainability assessments. To address this, the scope of these tools should be expanded to include a broader range of activities and impacts.

Several barriers to effective and future-oriented monitoring were identified, including financial constraints, limited time and resources, insufficient regulatory support, and challenges in engaging suppliers and partners. Stakeholders also face difficulties in measuring and reporting on sustainability metrics. Overcoming these barriers requires coordinated efforts from festival organisers, tool developers, and legislators to create supportive policies, provide financial incentives, and foster collaborative networks for data sharing and best practices.

Insights from frontrunners in the Dutch festival sector highlight the importance of strong leadership, clear sustainability goals, and continuous improvement processes. Successful sustainability initiatives are driven by intrinsic motivations, such as a commitment to environmental responsibility, and extrinsic pressures, such as stakeholder demands and regulatory requirements. Integrating sustainability into the core business strategy ensures that it is a fundamental aspect of event planning and execution.

In conclusion, the effectiveness and future orientation of monitoring tools can be safeguarded by ensuring they are comprehensive, inclusive of a broad range of activities and impacts, and supported by a regulatory framework that promotes sustainability. Festival organisers can enhance these tools by embedding sustainability into their strategic planning and leveraging technology for accurate and efficient data collection and reporting. Tool developers should create adaptable and user-friendly platforms to meet the diverse needs of the sector.

This research lays the foundation for developing a standardised protocol for environmental sustainability assessments for festivals. By identifying relevant activities and impacts and offering recommendations to overcome barriers, it contributes to establishing more effective monitoring practices. Furthermore, it provides guidance for festival organisers, tool developers, and legislators on fostering conditions for sustainable conduct, ultimately supporting a transition to a more environmentally sustainable festival sector.

1 Introduction

This study underscores the importance and great opportunities of environmental sustainability in the festival sector. Festivals serve as influential cultural hubs where sustainable behaviours can be promoted and normalised, they can serve as living labs for sustainable innovations, and act as driving forces for societal transitions. By addressing the environmental impacts associated with festival activities, the sector can drive a shift towards more sustainable practices, not just within the industry but also among festival-goers and wider society. This study aims to address the pressing need for effective and future-oriented monitoring tools to enhance the environmental sustainability of festivals. This first chapter discusses in more detail the societal and scientific relevance of the study, followed by the research aim and the specific research questions that guide this investigation.

1.1 Societal Relevance

The alarming state of the global natural environment and ever-growing anthropogenic pressures on the Earth system present an urgent need for humanity to counteract these developments. The ominous crossing of six out of nine *planetary boundaries*, as indicated by Richardson et al. (2023), clearly indicates that human activities are pushing beyond the safe operating space of the Earth's ecosystems. The effort of the international community to address these environmental issues is reflected by, for example, the historical *Paris Agreement* (UN, 2016) and the instigation of the *European Green Deal* (European Commission & Secretariat-General, 2019). In the Netherlands, the national government addresses climate change and resource consumption through the *Klimaatakkoord*, the Dutch National Climate Agreement (Rijksoverheid (Dutch Government), 2019), and its goals of achieving a circular economy by 2050 (Rijksoverheid (Dutch Government), 2020).

Against this broader societal backdrop, an increasing number of actors in the festival sector have started addressing sustainability issues related to the organisation and operation of their events. Festivals and events affect the environment through impacts such as greenhouse gas (GHG) emissions resulting from energy consumption, material use and consumption, and waste management (Cavallin Toscani et al., 2022, 2024; Toniolo et al., 2017), use and degradation of the planet's productive surface areas (Andersson et al., 2013; Toniolo et al., 2017), and the release of ecotoxic compounds into air and water (Toniolo et al., 2017). Initiatives like the *Green Deal Circular Festivals* (GDCF, 2019) and *European Green Festival Roadmap 2030* (YOUROPE, 2023) lay down ambitious goals to improve sustainability of the sector, aiming for circular and climate-neutral festivals.

Mair and Smith (2021, p. 1740) recognise the need to "go beyond merely making events more sustainable", and instead consider how events and festivals "might contribute to the wider

sustainability agenda". In accordance with Getz (2017) and Mair (2019), they argue event organisers should focus on contributing to the sustainable development of the places which host them. Festivals can, for example, have positive environmental impact by raising awareness of environmental issues or promoting sustainability education and through the development and long-term conservation of the festival site (Laing & Frost, 2010; Raj & Musgrave, 2009).

This sentiment is reflected within the industry itself by, for example, the parties united in the GDCF. Initiated by the Dutch government, the Green Deal currently comprises 47 large frontrunner festivals from 17 countries in Europe collaborating on the road to fully circular and climate neutral festivals (GDCF, 2019). In the *GDCF Agreement* (2019), the parties involved underpin their believe of festivals as microcosms and living labs with an opportunity to inspire and accelerate societal transitions.

In order to successfully transition to a sustainable festival sector, Cavallin Toscani et al. (2022) argue it is crucial to assess the environmental impacts of festivals. Already, some festival organisers and other stakeholders (e.g. Lowlands, DGTL, certain members of the GDCF) have taken proactive steps and started measuring and monitoring the environmental impacts of their events. To support these parties in quantifying environmental sustainability, several organisations and initiatives have developed ICT tools for impact assessment of events and festivals. Some Dutch examples of festival-specific tools are *EventFlux*, the *GDCF Monitor*, *Milieubarometer*, and *ZERO*[1].

This landscape of tools, however, shows great heterogeneity in methods and scope. Some of the tools, for example, focus merely on a festival's carbon footprint while others consider a broader selection of environmental topics. Still, when organisations do report on the same environmental impacts, there are no standardised protocols describing how the assessment should be performed (Bakos, 2019; Boggia et al., 2018; Cavallin Toscani et al., 2022; Sherwood, 2007). This means that, currently, there are no guidelines prescribing which environmental impacts should be considered, which indicators to use to quantify and assess these impacts, which event-related activities to include in the scope of the assessment, how to go about making assumptions, et cetera. With such variations between tools, the quality, comparability, and consistency of reports cannot be assured (Tschopp & Nastanski, 2014).

Standardisation of these assessment and reporting methods would enhance harmonisation between sustainability reports, increasing their consistency and comparability (Cavallin Toscani et al., 2024; Einwiller et al., 2016; Sherwood, 2007; Tschopp & Nastanski, 2014). This can

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[1] EventFlux is a tool supporting material flow analysis and carbon footprinting (https://event-flux.com/). The GDCF Monitor allows for assessment of impacts related to greenhouse gas emissions, waste, and water consumption (https://circularfestivals.nl/monitor). Milieubarometer is a carbon footprinting tool for different types of organisations, which has a module specifically targeted at festivals (https://www.milieubarometer.nl/). ZERO is a carbon footprinting tool (https://www.go-zero.io/).

facilitate benchmarking, mitigate biased selective reporting, increase the credibility and useful-ness of information for decision makers, and foster healthy competition between organisations (Einwiller et al., 2016; Tschopp & Nastanski, 2014). Moreover, the establishment of such stand-ards – even as they keep evolving – provides a foundational framework for sector-wide targets, policies, and regulations. Ultimately, standardisation contributes to an enhanced incentive for organisations to improve their environmental performance (Tschopp & Nastanski, 2014) and leads to a cohesive and concerted effort toward sustainable practices.

Ensuring that these efforts realise the most ambitious results in a continuous quest of staging the most sustainable festivals requires organisations to move past an attitude of *compliance*. According to Chen and Chen (2019, p. 625), organisations showcase sustainability compliance when they "exert average or minimum effort, without inner conviction or enthusiasm". The au-thors stress the need to transition from compliance to commitment, suggesting organisations should strive for "proactive and continuous efforts to manage (…) environmental challenges" (Chen & Chen, 2019, p. 624). A highly standardised and effective method for environmental sustainability assessment for festivals, which does not consider and promote these principles of continuous improvement and future orientation will not enable the sector to live up to its true potential.

1.2   Scientific Relevance

The scientific body of knowledge on environmental sustainability of events is rapidly expanding but remains relatively young with most papers published from 2010 onwards (Cavallin Toscani et al., 2024). Their expansive literature, however, shows that the field is heavily fragmented. The authors identify the cross-disciplinarity of the topic, the lack of dedicated academic outlets and the majority of lead authors publishing "one-off articles" on the topic - signalling "oppor-tunistic" behaviour by researchers - as likely causes of this fragmentation (Cavallin Toscani et al., 2024, p. 17).

In this light, scholars seem to agree on the fact that there is a need for more research on sus-tainability reporting in non-manufacturing sectors (Martins et al., 2022) such as the tourism and event sector (Cavallin Toscani et al., 2024; Mallen et al., 2010; Martins et al., 2022; Sánchez-Camacho et al., 2022). Specifically, there are widespread calls for the development of standard-ised assessment protocols for environmental impact evaluation in the event sector (Boggia et al., 2018; Brown et al., 2015; Cavallin Toscani et al., 2022, 2024; Dickson & Arcodia, 2010; Getz & Page, 2016; Mair & Whitford, 2013; Scrucca et al., 2016; Sherwood, 2007; Toniolo et al., 2017). Several attempts have been made to address this call, but none of these methods have yet been able to reach a level of institutionalisation (Cavallin Toscani et al., 2022). This mismatch between research and practice is recognised by Cavallin Toscani et al. (2024), who identify the

fragmentation of the field and the inconsistent, partial, and single-event methods in the literature as possible causes of the problem.

The shortcomings of the current scientific body of knowledge are characterised by a number of specific literature gaps. First, despite the importance of the concepts of continuous improvement and future orientation as expressed in the previous section, none of the methods proposed in the scientific literature include mechanisms to safeguard these principles. Secondly, the literature exhibits controversy on which environmental impacts to consider and which operations to include in the system boundaries for the assessment. Specifically, most methods applied or developed in the academic literature quantify at least the GHG emissions of events and consider operations related to energy consumption, water consumption, and waste management (Andersson & Lundberg, 2013; Boggia et al., 2018; Cavagnaro et al., 2022; M. Jones, 2014; Raj & Musgrave, 2009; Sherwood, 2007). Of these methods, however, only a limited number assess impacts such as land use, water consumption, biodiversity, and pollution and include operations related to pre-event activities, transport and travel, infrastructure, food and beverage production and consumption, material production, and accommodation.

There are several limitations of previous studies that contribute to the abovementioned controversies between methods. Authors often do not specify the methods and criteria used for selection of the impacts and operations to include in their assessments. Because of the minimal attention given to these aspects of the research design and apparent lack of comprehensiveness of proposed methods, it is not obvious to assume that thorough and systematic approaches have been applied during method development. The lack of transparency regarding authors' considerations and the methods they employ not only hinders replicability of the studies, but also complicates the clarification of inconsistencies between various studies and diminishes the reliability of their findings.

Furthermore, the predominant focus of assessment methods on GHG emissions presents another limitation: Although GHG emissions, to some extent, can serve as a proxy for total environmental impact (Cavallin Toscani et al., 2022; Laurent et al., 2012), some environmental impacts show no significant correlation with the carbon footprint (Kalbar et al., 2017; Laurent et al., 2012; Röös et al., 2013). This poses a risk of problem shifting, where emission reductions may inadvertently lead to increased environmental pressures across other domains (Laurent et al., 2012). For events specifically, Cavallin Toscani et al. (2022) state that more research and testing is needed to ensure the suitability of a carbon footprint as a proxy for environmental sustainability.

The studies by Toniolo et al. (2017) and Cavallin Toscani et al. (2022) attempt to counter these shortcomings by taking a comprehensive and systematic life cycle assessment (LCA) approach to the measurement of the environmental impact of events. The latter, however, identify shortcomings in the work by Toniolo et al. (2017) in the application of the LCA approach to just a

single case study, limiting the external validity of the developed method. The most comprehensive approach, a uniform life cycle model for events by Cavallin Toscani et al. (2022), is limited to urban events, thus not encompassing all event typologies, particularly those in rural settings. In conclusion, the comprehensiveness, and future orientation of the environmental sustainability assessment methods for events and festivals presented in the literature cannot be guaranteed. This fragmentation and academic gap necessitates a consolidated model to ensure that sustainability tools can accurately assess all environmental impacts of festivals, thereby avoiding problem shifting and enhancing their effectiveness.

The contribution of this work is to improve on the common practice and to identify ways to incorporate characteristics of future-orientation and continuous improvement. Current fragmentation in event models and assessment methods is addressed by consolidating different perspectives into a more comprehensive whole. Through this, the current gap between literature and practice is bridged as approaches from both academia and practice are consulted and incorporated.

1.3   Research Aim

In response to the existing gap in the field of environmental sustainability assessments of festivals, this study seeks to **contribute to a more environmentally sustainable festival sector by providing actionable recommendations to improve the effectiveness and future orientation of monitoring tools**. The aim of this research is twofold. First, the study aims to be a next step towards a standardised protocol for environmental sustainability assessments for festivals specifically and events in general, exploring the activities and impacts that are relevant for a comprehensive assessment. This concerns not only current methods and tools in their contemporary limitations, but, through a focus on future orientation, aims to define ambitions for, say, the coming 25 years. This way, the study aims to ensure that effective sustainability monitoring tools can come to function as vehicles for continuous improvement of festival sustainability. Secondarily, the goal is to provide suggestions for festival organisers, governmental organisations, tool developers, and other stakeholders in the sector to foster conditions for more – and continuously improving – sustainable conduct.

The first aim is addressed by a comprehensive exploration and comparison of current monitoring tools to evaluate their scope, particularly regarding the activities they include and the impacts they report. By identifying and analysing the relevant criteria for inclusion and exclusion, this study aims to help define the boundaries required for comprehensive assessment. Furthermore, it delves into the practical considerations of these activities, assessing their relevance and the rationale for their inclusion or exclusion. Additionally, the study seeks to understand the significance of various environmental impacts, establishing a solid foundation for

assessment methodologies that truly capture the environmental effects of festivals and can be widely adopted across the festival sector.

The second aim involves identifying the existing barriers to effective monitoring and sustainable practices, both from the perspective of festival organisers and policy makers. By examining the current motivations and potential incentives that could drive continuous improvement, the study aims to define strategic suggestions to enhance the comprehensiveness of monitoring tools, lower the barriers to their adoption, and increase the overall motivations and incentives for sustainable conduct. These recommendations are designed to support a collaborative effort among stakeholders, including sector networks, special interest groups, and governmental organisations, to create an enabling environment that promotes and sustains continuous improvement of sustainability performance within the festival industry.

1.4   Research Questions

Considering the identified societal need for a more sustainable festival sector and the literature gap regarding environmental sustainability assessment, this study plans to fulfil the research aim outlined in Section 1.3 by answering one main research question. This overarching question serves as guide to explore comprehensively the dynamics of environmental impact assessment in the sector and is formulated as follows:

> **Research question:** How can the effectiveness and future orientation of monitoring tools for the environmental sustainability of festivals be safeguarded?

To address the complexities surrounding this inquiry, three specific sub questions have been formulated to uncover challenges and potential solutions. These are articulated in the following manner:

> **Sub question 1:** How comprehensive is the assessment of environmental impacts of festivals in current tools and how could this be improved?

> **Sub question 2:** What barriers to effective and future-oriented monitoring do stakeholders in the festival sector experience?

> **Sub question 3:** Which lessons can be learnt from frontrunners in monitoring and environmental sustainability in the Dutch festival sector with regards to future orientation and continuous improvement?

2 Theory

Because of the interdisciplinary nature of environmental sustainability in general and in the festival sector in particular, this study will integrate insights from multiple fields of research (Figure 1). The main fields are sustainable development, planned event studies, and innovation and transition studies. The relevant theories from each of these disciplines are discussed in the subsections below.
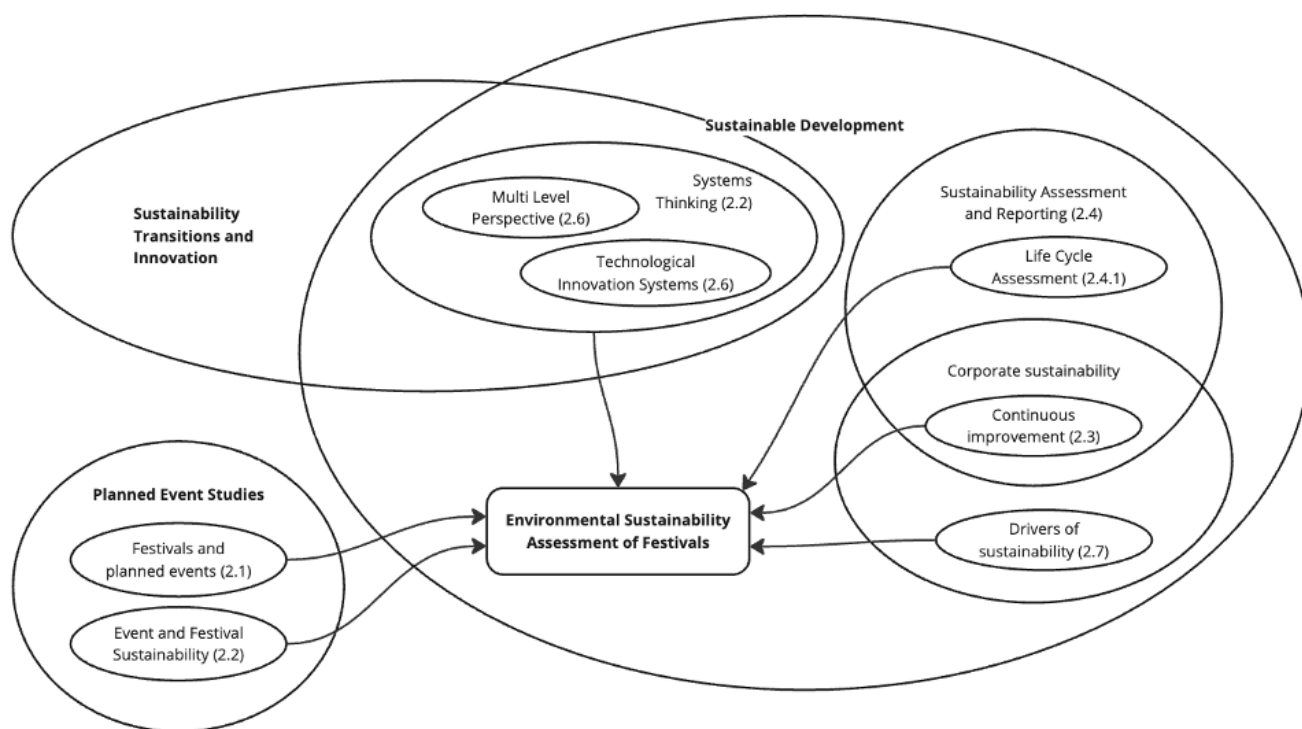
Figure 1. Theoretical framework showcasing the relations between relevant theories and the topic of this study

2.1 Festivals and Planned Events

Festivals are dynamic and highly diverse socio-cultural phenomena. The term is used to indicate a broad range of different types of gatherings and festivities. Traditionally, the term *festival* is used mostly in the context of cultural and religious celebrations. This classical, cultural-anthropological perspective is reflected by Falassi (1987), who describes festivals as social occasions which occur periodically as series of coordinated events in a multiplicity of forms in which all members of a community, sharing the same worldview, directly or indirectly participate.

Nowadays, the term festival is applied much more broadly. Festivals attract diverse, international crowds, not limited to specific communities. Festival attendees often still share some sort of interest, but do not necessarily adhere to common world views. To date, the most commonly used definition for festivals is the simple approach by Getz (2007, p. 31), who describes them as "themed, public celebrations". Wilson et al. (2017, p. 197) expand on this definition by stressing the fact that festivals "are held regularly" to distinct them from special events, which are onetime or infrequently occurring events. However, boundaries between event typologies are blurring, with, for example, some festivals now including conferences, and educational and business events becoming more festive (Mair & Smith, 2021). Many "so-called festivals" are merely entertainment or promotional events, rather than true celebrations (Getz, 2007, p. 183).

To circumvent the ambiguity around the festival definition, Getz et al. (2010) take the approach of selecting events that call themselves a festival or belong to a festival association. They argue that festivals are social constructs and "can mean something different from nation to nation" (Getz et al., 2010, p. 30). As festivals fall under the broader umbrella of planned events, some additional guidance for the meaning of the concept can be found in the overarching definition. The approach of Getz (2007) is well suited in the context of this work, because it considers the environment, event setting, and stakeholders (Case, 2013). Planned events are "created to achieve specific outcomes" and result in unique, personal experiences, "arising from the interactions of setting, program, and people" (Getz, 2007, p. 46).

2.2 Festivals and the Environment

Apart from intended, positive outcomes, festivals also have unintended negative economic, social, cultural, and environmental outcomes (Getz, 2007). Festivals interact with the natural environment both directly by impacting the host location and its surroundings and more indirectly through its supply chain, energy and resource consumption, transportation, emissions to air, water, and soil, and waste flows (Case, 2013; Cavallin Toscani et al., 2022; Raj & Musgrave, 2009).

Case (2013) takes a systems approach to the environmental context of events, acknowledging events as complex systems embedded in larger socio-environmental systems. He proposes a model illustrating how natural raw materials (such as food, fuel, and minerals) serve as inputs to the event system and are transduced through energy conversion, raw material processing, and fuel consumption (see **Error! Reference source not found.**). The results of these processes are discharged into the environment as wastes. These outputs may be 'recycled' over different timescales, some of which geological, meaning that these resources are unavailable to humanity in normal lifespans (Case, 2013) and constitute ecological disturbances such as pollution and climate change.
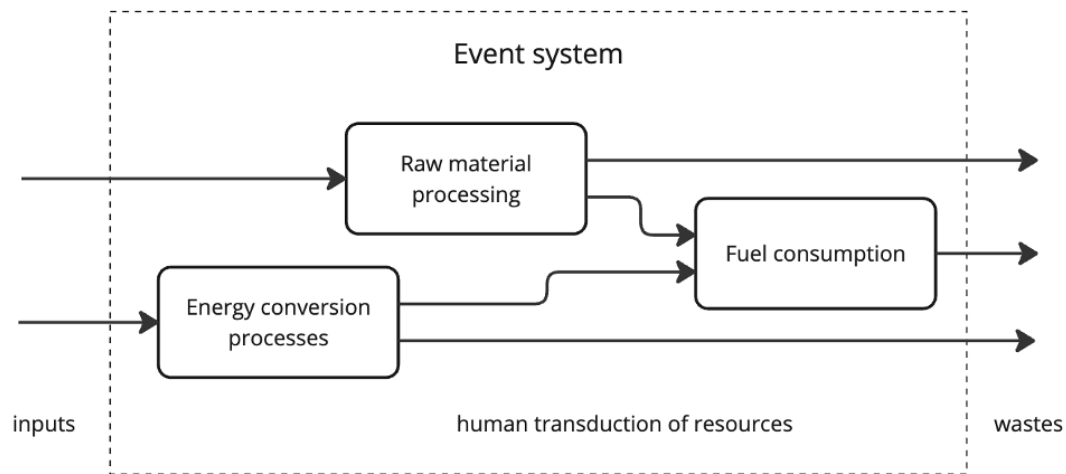
Figure 2. Model of the event system in its environmental context (adapted from Case, 2013)

The notion of festivals as complex socio-environmental *systems* is central to this theoretical framework. Bergek et al. (2008, p. 3) define a system as "a group of components (devices, objects or agents) serving a common purpose." Drawing on systems theory, the components of festival systems can be viewed as interdependent and interconnected entities influenced by diverse stakeholders, resource flows, and feedback mechanisms. Adopting a systems approach allows for analysis of the environmental impacts of festivals in a holistic manner, considering the interactions between different stakeholders, activities, and impacts.

2.3   Continuous Improvement

The importance of acknowledging the interconnectedness in the system becomes apparent, for example, in the rebound effect, a concept from systems dynamics. First introduced by Khazzoom (1980), the concept underscores the risk of potential unintended consequences of sustainability interventions. This effect can be exemplified with a festival that may install energy-efficient lighting and sound systems, but when organisers then add extra stages or more elaborate setups, initial savings are nullified. Similarly, purchasing renewable electricity, often considered carbon-neutral, may reduce the incentive to conserve energy. The rebound effect may cause overall electricity consumption to increase. This increased demand for renewable electricity causes the (unnecessary) consumption of a scarce resource. When the limited supply at a given moment is consumed, additional demand is met by conventional, fossil energy sources. But still, even though electricity might be renewable, PV panels, wind turbines and all other necessary infrastructure have limited lifetimes and limited total production capacity.

Wasting any of that should not be considered sustainable, even if there might appear to be no direct environmental impacts.

Not only does sustainability require a holistic, systemic approach. Through the perspective of system dynamics, sustainable development is understood as "an unending process defined neither by fixed goals nor by specific means of achieving them" (Hjorth & Bagheri, 2006, p. 1). Ensuring sustainability in the context of festivals requires similar commitment to continuous improvement (Cavagnaro et al., 2022; Getz, 2018). The Deming cycle, or PDCA (Plan, Do, Check, Act), introduced by W. Edwards Deming in the 1950s, is a renowned methodology for continuous improvement (Swamidass, 2000). Vermeulen and Witjes (2016) emphasise the importance of regular self-assessment for continuous improvement in corporate sustainability, aligning with the Check step of the PDCA model. Corporate social responsibility (CSR) theory advocates for organisations to address and report on their social, environmental, and ethical impacts, fostering responsible decision-making (Pranugrahaning et al., 2021). Integrating assessment results into strategic management as part of the continuous improvement process supports organisational responsibility and sustainability practices (España et al., 2019).

2.4   Sustainability Assessment and Reporting

To address the absence of sector-specific standardised methods and protocols for festivals, this research draws upon theories, standards, and methodologies that have a more general focus and are already widely accepted. The study builds upon the key concepts of the *Life Cycle Assessment* (LCA) methodology because of the method's comprehensive approach encompassing the entire scope of festivals in this case. The value of the method for events is recognised in several previous academic works (e.g., Cavallin Toscani et al., 2022; Toniolo et al., 2017). *Environmental Impact Assessment* (EIA) is another standardised and institutionalised method for quantifying environmental impacts, this is, however, not a common method for (temporary) events, because of its long duration and predominant focus on local impacts (Enríquez-de-Salamanca & Díaz-Sierra, 2023).

2.4.1   *Life cycle assessment*

The LCA method is applied to assess the environmental impact of a product or service that occurs throughout its entire life cycle. The framework and principles of LCA are consolidated and established in a confirmed International Standard (Finkbeiner, 2014; ISO, 2006). This provides a solid foundation for a structured methodology for evaluating the environmental impact of festivals. The method encompasses four stages (ISO, 2006), where the stage of *goal and scope definition* which precedes the actual measurement of impacts can provide guidance in the process of suggesting improvements for current assessment approaches for festivals.

The LCA methodology offers valuable guidance for sustainability assessments by considering the entire life cycle of a product or service, aligning with the four stages in the life cycle of an event, defined by Boggia et al. (2018): Planning, organisation, implementation, and post-event. The LCA method further emphasises the importance of defining a system boundary, delineating the criteria for which unit processes or activities and which resource flows to include in the assessment scope (Jolliet et al., 2015). The system boundaries for sustainability assessment of festivals are discussed in the upcoming section.

2.5   Festival-related activities

Currently, both the academic and grey literature lack a comprehensive model of festival-related activities. The existing literature provides various models and frameworks primarily for events, each addressing the event system in different levels of breadth, detail, and comprehensiveness. This fragmentation hinders the ability to thoroughly assess the quality and comprehensiveness of current tools used for sustainability monitoring in the festival sector. To ensure effectiveness of tools, it must be guaranteed that they provide a complete picture of all environmental impacts related to the festival. Otherwise, tools remain at risk of overlooking important sources of environmental harm and can lead to problem shifting. To bridge the gap, this section seeks to construct a consolidated model by synthesising several incomplete models and overviews from different sources.

The most comprehensive approach in the scientific literature is proposed in the form of a uniform life cycle model for events (Cavallin Toscani et al., 2022). The authors themselves, however, already admit the model's limitations in that is does not encompass all event typologies. The study focussed on one specific municipality, limiting the scope to urban events, while many festivals occur in rural, 'greenfield' settings. Another relatively comprehensive model in the scientific literature is the one underlying the METER index proposed by Boggia et al. (2018). Even though the model is not developed for quantitative assessment as METER is a qualitative approach to sustainability measurement, its deviations from the model by Cavallin Toscani et al. (2022) provides a useful contribution.

Another model for event-related activities is found at the Institute for Sustainable Events, the platform recently used by event management scholar and experienced event sustainability consultant Meegan Jones to publish a review of several carbon footprint calculators for events (ISE, 2024). Because of Jones' academic background and real-world experience with event sustainability management and monitoring, this model was used as the basis for the consolidated model. The model was supplemented with activities from the other sources (Boggia et al., 2018; Cavallin Toscani et al., 2022) where necessary. The consolidated model of festival-related activities is presented in Table 1.

Table 1. Consolidated model of festival-related activities (based on Boggia et al., 2018; Cavallin Toscani et al., 2022; ISE, 2024)

Theme	Activity	Source
Energy	Electricity from grid	ISE (2024)
	Temporary electricity generation	ISE (2024)
	Gas (grid, bottled)	ISE (2024)
	District heating and cooling	ISE (2024)
Travel	Attendee	ISE (2024)
	Participant*	Cavallin Toscani et al. (2022)
Transport	On-site and building equipment	ISE (2024)
	Off-site (air, sea, land)	ISE (2024)
Water	Drinking water	ISE (2024)
	Non-drinking water	Boggia et al. (2018)
	Wastewater treatment	ISE (2024)
Food and beverage	Attendee food	ISE (2024)
	Participant* food	Cavallin Toscani et al. (2022)
	Beverage	ISE (2024)
Materials	Procured	ISE (2024)
	Rental	ISE (2024)
	End-of-life	ISE (2024)
	Waste management	ISE (2024)
Accommo-dation	Attendee	ISE (2024)
	Participant*	ISE (2024)
Digital	Online activity	ISE (2024)
	Digital events	ISE (2024)

*= Participants include all individuals taking an active part in the festival, such as volunteers, crew, artists, and suppliers (ISO, 2012).

2.6 Multi-Level Perspective and Technological Innovation Systems

In order to understand how tools can be effective in contributing to continuous sustainability improvement, it is imperative to understand how and why tools are adopted, but also to understand the bigger system in which they are part. Innovation systems theory and the multi-level perspective (MLP) on socio-technical transitions can help understand this context and the dynamics within. The theory of innovation systems proposes that innovation and technological advancements are not solely the result of isolated actions by individual entities, but rather emerge from the interactions and collaborations within a network of diverse actors, institutions, and policies. Through the MLP, it is understood that transformative changes in society, such a shift towards sustainable festivals, occur through dynamic interaction across and between macro, meso, and micro levels (Geels, 2002). A conceptual visualisation of the MLP framework is shown in Figure 3 (Schwery, n.d.).
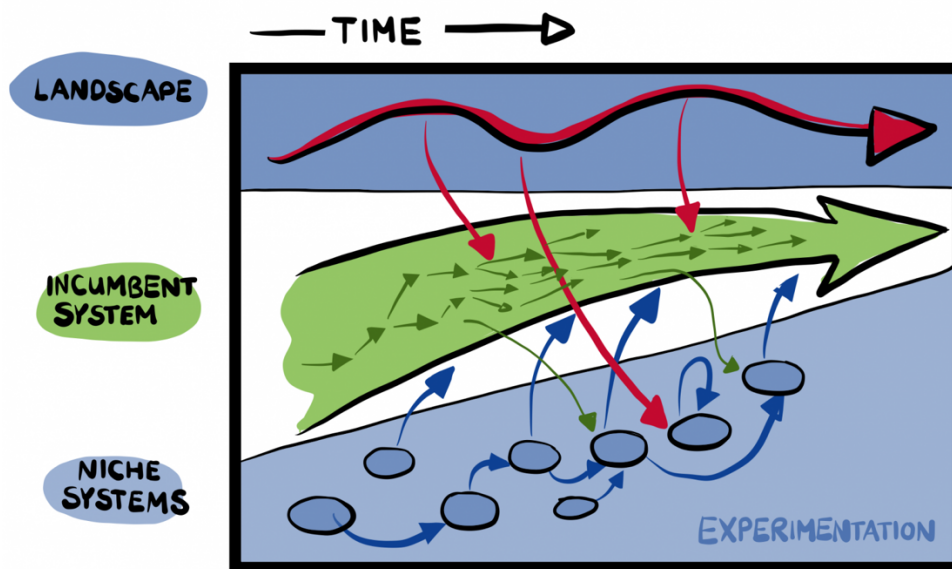
Figure 3. Visualisation of the MLP and the dynamics between the incumbent system and emerging niche systems under the influence of the landscape conditions (Schwery, n.d.).

The macro level, or *socio-technical landscape*, sets the context for technological trajectories, shaped by deep structural trends. The meso level, termed the *socio-technical regime*, encompasses the coordinated activities of actors associated with the incumbent technology. Regimes are less resistant to change than landscapes, allowing for incremental innovation. Radical transitions occur at the micro level in *niches*, influenced by the existing landscape and regime. The key insight of the MLP is that innovation success depends on adoption from a niche into the regime, consequently changing the landscape. Similarly, changes in the landscape and regime can reinforce niche development.

In the context of this study, sustainability monitoring and sustainable festivals are considered niche developments. These niches arise and develop because developments at the landscape level, such as growing environmental concerns, provide pressure and opportunity for alternatives to traditional ways of organising festivals. These niches are currently gaining momentum and can eventually influence and disrupt the established regimes. The MLP framework is used in this study understand the complexity and interconnectedness of change at different levels and to inform how coordinated efforts can lead to a successful transition to a sustainable festival sector.

Considering the festival sector as a system with innovation objectives, the innovation systems framework provides insights into its dynamics. According to Bergek et al. (2008), components of an innovation system include actors, networks, and institutions contributing to the development and diffusion of new goods, services, or processes. In the festival system, these actors comprise festival organisers, industry associations and networks, local and national governments, supply chain participants, attendees, and knowledge institutes. The specific type of innovation system relevant for this study is the Technological Innovation System (TIS) as it focuses on a specific technology, festival sustainability monitoring tools in this case. Technology here is broadly defined, encompassing material and immaterial objects and technical knowledge (Bergek et al., 2008).

To better understand and guide technological change and innovation, Hekkert et al. (2007) identified the activities within TISs that lead to technological change, calling these *functions of innovation systems*. These functions contribute to the overall goal of the innovation system and build on the MLP (Geels, 2002; Hekkert et al., 2007). The goal of this approach is to assess the circumstances under which a niche can grow and develop into a part of the incumbent regime. Mapping the presence of these functions in a system provides insight into system dynamics and identifies obstacles to successful technology development and diffusion, indicating areas for policy attention.

Hekkert et al. (2007) define seven functions of technological innovation systems: F1. *Entrepreneurial activities*; F2. *Knowledge development*; F3. *Knowledge diffusion through networks*; F4. *Guidance of the search*; F5. *Market formation*; F6. *Resources mobilisation*; and F7. *Creation of legitimacy/counteract resistance to change* (i.e. *lobbying by entrepreneurs*). The authors state that relations and dependencies exist between these functions, meaning that when a function is fulfilled, this can create positive feedback loops, creating a reinforcing effect. These virtuous cycles are called *motors of change* (Hekkert et al., 2007; Suurs & Hekkert, 2012).

Suurs and Hekkert (2012) identify four motors of change whose presence correlates with the level of maturity of the TIS: The Science and Technology Push Motor, Entrepreneurial Motor, System Building Motor, and the Market Motor. The authors show that motors tend to build on

each other and that they generally succeed each other in a set order (Figure 4). Because of the suggested progressive sequence of the motors, they can be considered as different stages in the innovation process (Suurs & Hekkert, 2012). To ensure that policies are successful in supporting technology development and diffusion, governments should analyse and evaluate the innovation systems (Bagheri Moghaddam & Nozari, 2023). Prior to the formulation of such policies, the authors suggest identifying the system's current problems and shortcomings.
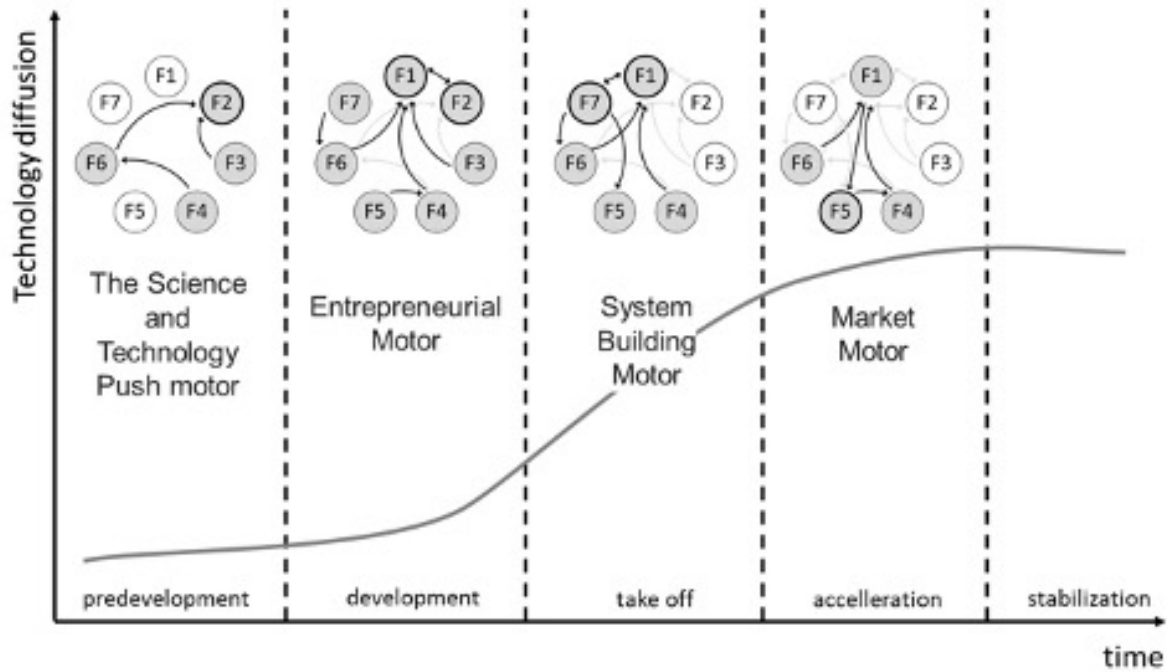
Figure 4. Succession of motors of change in a TIS over time

In conclusion, TIS and MLP theories can offer valuable insights into the sustainability transition in the festival sector. They aid in analysing innovation dynamics, identifying barriers to change, and understanding the roles of various actors and institutions in promoting sustainability assessment. Understanding the current state of innovation can inform recommendations for necessary interventions to promote the adoption of sustainability monitoring tools and help disrupt incumbent regimes in order for sustainable festivals to become the norm.

2.7   Drivers of Sustainability

To achieve long-term environmental sustainability in the festival sector through continuous improvement cycles, understanding the drivers and barriers to sustainability is crucial. This understanding enables the design of effective strategies and policies for improving sustainability performance.

2.7.1 Drivers of corporate sustainability

Bansal and Roth (2000) identify three primary motivations for corporate ecological responsiveness: competitiveness, legitimation, and ecological responsibility. Competitiveness relates to improving long-term profitability, legitimation involves aligning actions with current regulations, norms, and values, and ecological responsibility is driven by the company's commitment to social obligations. According to their review of the literature, the key drivers of corporate sustainability include legislation, stakeholder pressures, economic opportunities, and ethical motives, often influenced by leadership and corporate values. Organisational motivation is shaped by the strength of networks, the significance of environmental concerns to these networks, and the individual concerns of actors within the organisation (Bansal & Roth, 2000).

Idowu and Louche (2011) highlight multiple reasons for engaging in CSR practices, such as intrinsic motivations to improve the business, or idealistic values and a sense of social responsibility. Extrinsic motivations include peer, stakeholder, or investor pressure. Implementing sustainability ideals can enhance relationships with government and communities and improve risk and crisis management abilities.

Lozano (2015) presents a holistic perspective on how companies could achieve a more proactive approach to corporate sustainability, effectively advocating for future orientation and continuous improvement. The author recognises internal and external drivers. Main internal drivers include leadership, business case, company culture, and sustainability reporting (Lozano, 2015). The business case encompasses potential long-term cost savings and impacts on reputation or financial costs if sustainability is not addressed. External drivers identified by the author include customer demands, company reputation, and regulation and legislation.

Regarding sustainability reporting, Hahn and Kühnen (2013) note that variables like company size, visibility (e.g., media exposure, supply chain position), and sector affiliation (i.e., high impact sectors are more likely to report due to higher stakeholder pressure) are consistently associated with sustainability reporting practices. However, the authors note that few variables identified in their review receive sufficient attention and show results with high enough consistency to draw clear conclusions.

2.7.2 Drivers and barriers of festival sustainability

With a focus specifically on the 'greening' of music festivals Mair and Laing (2012) identify several motivations and barriers, highlighting the important role of the festival manager as champion and steward of greening. Key drivers include the personal values or ethos of the manager, stakeholder demand for sustainability, and the organisational desire to educate and act as

sustainability advocates. Key barriers include financial costs, lack of time, lack of control over festival venues, and difficulties in sourcing appropriate suppliers or supplies.

De Brito and Terzieva (2016) propose a model for events developing strategies to generate social and environmental value, consisting of three phases: The first stage is one of discovering, where visionary leadership, sustainable ambition, risk-taking, and authenticity are crucial. Authenticity here involves collaboratively defining and agreeing on a sustainability vision within the organisation. For the second (development) phase, the authors stress the importance of tailor-made solutions that are developed with strong customer orientation and strengthened by strategic partnerships. The final phase involves delivery of the strategy. Here, innovativeness and "walking the talk" are key, as introducing new services, products, or processes can deliver authentic experiences and enhance the potential of the event by harnessing the participatory voice of the participants (de Brito & Terzieva, 2016, p. 57).

In conclusion, the literature shows the multifaceted nature of drivers to sustainability, identifying both internal and external factors that influence organisations' behaviour. In terms of internal drivers, visionary leadership and corporate culture play an important role (Bansal & Roth, 2000; de Brito & Terzieva, 2016; Mair & Laing, 2012), as well as the business case (Idowu & Louche, 2011; Lozano, 2015), motivations to improve business operations (de Brito & Terzieva, 2016; Idowu & Louche, 2011), and a desire to enhance the organisation reputation (Idowu & Louche, 2011; Lozano, 2015). External drivers involve pressure from stakeholders (Hahn & Kühnen, 2013; Idowu & Louche, 2011; Mair & Laing, 2012) and regulations (Bansal & Roth, 2000; Lozano, 2015; Mair & Laing, 2012), and strategic partnerships and relations with other stakeholders (de Brito & Terzieva, 2016; Hekkert et al., 2007; Idowu & Louche, 2011).

3 Methodology

The present chapter builds on the theoretical foundation laid down in the previous chapter, defines the scope of the research, and explains the methodology used to address the three sub research questions outlined in Section 1.4. The methodology outlined in the following sections provides a structured approach for data collection and analysis in the three stages of this research, which correspond with the sub questions: SQ1. How comprehensive is the assessment of environmental impacts of festivals in current tools and how could this be improved? SQ2. What barriers to effective and future-oriented monitoring do stakeholders in the festival sector experience? SQ3. Which lessons can be learnt from frontrunners in monitoring and environmental sustainability in the Dutch festival sector with regards to future orientation and continuous improvement?

3.1 Data Collection and Analysis

This study applied a multidisciplinary approach to address the three questions. To gain insight into the current landscape of monitoring tools, the study analyses and compares the contents of a selection of tools. To address the other research objectives, the research builds on semi-structured interviews with festival stakeholders. These participants were, first of all, inquired about criteria for setting the boundaries of impact assessments and the requirements to ensure comprehensiveness of such monitoring. Secondly, stakeholders were asked about barriers to the effectiveness and future orientation of the tools, discussing barriers for organisers to start measuring, for actors in the supply chain to behave more sustainably, and for governments, regulators, and licensing authorities to implement policies related to festival sustainability. Lastly, the interviews discussed the motivations and incentives that drive organisers to engage in sustainability activities, start monitoring their sustainability performance, and seek continuous improvement.

3.1.1 Content analysis of current tools

The complete list of tools for analysis has been compiled using different methods. First of all, this analysis builds on the recent work done by Meegan Jones for the Institute for Sustainable Events (ISE, 2024) and comprises all tools included in her tool review as well as those suggested to her on LinkedIn by a broad range of event professionals (M. Jones, 2024). This already extensive list of tools is expanded by tools mentioned or represented in the "Events & Cultural Spaces" Working Group of the Carbon Accounting Alliance (CAA, 2024), tools mentioned by participants in the study, and tools identified through the following combination of search queries on Google: [(event OR festival) AND (environmental impact assessment OR sustainability OR carbon footprint) AND (tool OR calculator)]. This approach resulted in a longlist of **69 monitoring tools** in total.

The sample of tools to be included for further analysis was selected by checking for four criteria: Tools that are **suitable for festivals**, aim or claim to have a **full-event scope**, take a **quantitative assessment approach**, and are **accessible to the researcher**. The first criterion is set to prevent unjust comparison between tools that might not even be meant for the same purpose. To ensure that only tools for festivals are considered, tools are included if there is evidence of festivals using them or if festivals are explicitly mentioned as target audience on the tool's website or other communication channels. The scope of the assessment is considered to exclude niche, or single-issue tools that might skew the analysis results for comprehensiveness. If tools claim to assess the impact, footprint, or sustainability of an event – as opposed to an explicit focus on specific themes – and assess at least three of the identified themes, then this criterion is considered fulfilled. Quantitative assessment means that tools require numerical data as input and report on environmental impacts in an absolute, quantitative indicators.

Lastly, a more practical consideration, only tools for which sufficient data was available could be included. This means that free, open tools were included, as well as tools with sufficient publicly available data or those for which the developers provided the necessary information.

Initial examination of the 69 tools, resulted in the exclusion of 40 for not meeting all four of the selection criteria. For an additional 16 tools, it could not be verified that they met all criteria, due to limited publicly available information. The developers of these tools were contacted for clarity. Of them, eleven (11/16) did not respond, two (2/16) replied, but did not wish to participate or provided too little information, three (3/16) responded with sufficient information, three of which showed to meet the criteria for selection. The total number of tools included in the analysis then amounted to 15 out of 69 and are displayed in Table 2.

Table 2. Selection of sustainability monitoring tools for festivals

Tool	Developer	Country of origin
Climeet	Green Evénements	France
CO2-Calculator | Events	Climate Neutral Group, part of Anthesis	The Netherlands
Creative Climate Tools (CC Tools)	Julie's Bicycle	United Kingdom
Environment-i-meter	LAB Vlieland, Utrecht University	The Netherlands
Event Carbon Calculator	Tradewater	United States of America
Event Carbon Footprint Calculator	NetNada	Australia
GDCF Monitor (v2024)	Green Deal Circular Festivals	The Netherlands
Green Events Tool (GET)	UNFCCC secretariat, UNEP, GORD	Qatar, international
Green Producers Tool	Green Producers Club	Norway
Milieubarometer	Stichting Stimular	The Netherlands
myclimate Event Calculator	Foundation myclimate	Germany
Planet Positive Event	Toleranca Marketing	Slovenia
The Denver Eco Friendly Event CO2e Emissions Calculation Tool	Camco, City of Denver	United States of America
TRACE	isla	United Kingdom
ZERO	Go ZERO	The Netherlands

This resulting list of tools has been subject to content analysis to determine which activities are considered and which environmental impacts are assessed. As there is no comprehensive model for event or festival-related activities that currently boasts consensus, this study relies on the aggregated model as presented in Section 2.5 to function as a benchmark for the content analysis of activities. The full list of activities and an explanation of the evaluation criteria that were used to assess them is displayed in Table 7 in Appendix A.

The analysis of impact categories considered in the tools is done against the well-defined, widely recognised, and standardised ReCiPe 2016 framework. It is a "harmonised life cycle impact assessment method" that includes 17 environmental impact indicators representing the pathways through which three "areas of protection" (i.e. human health, ecosystem quality, and resource scarcity) can be impacted (Huijbregts et al., 2017, p. 138). As a scientifically-grounded and standardised approach, it provides a solid basis to benchmark current monitoring tools in terms of the breadth and extent to which they address environmental impacts.

The model was adapted slightly to accommodate for differentiation between water consumption that occurs on the festival site and water consumption in festival-related up- and downstream activities as those require significantly different measurement approaches. Some indicators were compiled into overarching categories to allow for easier interpretation of the results. The resulting indicators were: Climate change, ozone depletion, ionising radiation, fine particulate matter formation, photochemical oxidant formation, terrestrial acidification, freshwater eutrophication, human toxicity, ecotoxicity (including terrestrial, freshwater, and marine), land use, water consumption (on-site and up-/downstream), and resource scarcity (including mineral and fossil) (Huijbregts et al., 2017).

3.1.2 Semi-structured interviews and sample selection

The second part of the data collection was done through semi-structured expert interviews with festival sector stakeholders. Expert interviews allow for consideration of perspectives and insights from practice that are not yet represented in the academic literature. This is especially relevant in festival research, because of the limited coverage of the topic as discussed in Section 1.2 and the present gap between literature and practice in the events sector in general as stressed by Cavallin Toscani et al. (2024). The semi-structured approach allowed for flexibility in the interviews to focus on every interviewee's specific expertise and to explore relevant, but unexpected directions of the conversations.

Interviewees were selected using a generic purposive sampling approach, a form of non-probability sampling where participants are selected based on specific criteria (Clark et al., 2021). This kind of sampling does not allow for statistical generalisation, but rather the selection of

participants that can provide specific information and to ensure variety in the resulting sample (Clark et al., 2021).

In this study, the goal is to sample participants in a strategic way based on their knowledge and experience related to the festival and events sector, sustainability monitoring, or the current regulatory frameworks. Festival organisers specifically are selected to represent a diverse range of festivals. Three main categories of stakeholders are consulted in this study: 1. Sustainability managers of frontrunner festivals in environmental sustainability; 2. Experts in environmental sustainability and impact monitoring; 3. Stakeholders from governmental organisations and licensing authorities concerned with the (environmental) legislation and permit requirements for festivals.

The sample size for the interviews was based on the fact the goal of the study is not to build grounded theory, or to produce statistically valid claims that represent the entire population of festival stakeholders. Rather, it is to explore the perspectives of multiple different stakeholder groups. The selection of the stakeholder groups is discussed below, with the sample size per category determined by the number of perspectives necessary to represent the diversity within the group.

For the first group of stakeholders, sustainability managers at Dutch festivals partaking in the GDCF were approached. These festivals have committed to making their festivals more sustainable and can thus be expected to have assigned a sustainability manager or have employees explicitly assigned sustainability responsibilities. These people are assumed to be knowledgeable on the topic of environmental sustainability and experienced in festival production in general.

To address representativeness of the sample for the Dutch festival sector, stakeholders were carefully selected to include a diverse range of festivals. The selection was done based on festival characteristics. Of the event characteristics used by Cavallin Toscani et al. (2022), *location* (indoor, outdoor) and *duration* (single-day, multi-day) were used. Additionally, Brennan et al. (2019) distinguish 'greenfield' (rural) and urban festivals, characterising festivals by *setting*, and in terms of *spread,* between single-site and multi-site events. The final event characteristic used for differentiating festival types comes from a distinction made in the Dutch interpretation of the European 'Single-Use Plastic Directive' for events. The legislation applies different rules based on *accessibility*, distinguishing between open (freely accessible) and closed (ticketed) events (Min. IenW, n.d.). In the selection of the sample, a quota of at least one festival for each of the different options aimed to ensure a representative sample. Four festival sustainability managers were interviewed, representing a total of 14 festivals, displayed in Table 3.

Table 3. An overview of the interviewees from the festival sustainability manager (F) stakeholder category

Part. ID	Location	Duration	Setting	Spread	Accessibility
F1	Outdoor	Both	Both	Single-site	Closed
F2	Both	Multi-day	Both	Multi-site	Closed
F3	Outdoor	Multi-day	Rural	Single-site	Both
F4	Both	Multi-day	Urban	Multi-site	Open

Insights from sustainability managers at festivals were augmented through multiple interviews with experts on the relevant topics. The study consulted five experts from within the events and festival sector, including (with some overlap) actors with expertise on event sustainability (3/5), experts in sustainability monitoring for festivals and events (3/5), and two actors particularly knowledgeable on current legislation and permit processes in the sector (2/5).

Additionally, two external experts were consulted, primarily to ensure comprehensiveness in the consideration of environmental impacts and to draw lessons for the implementation of continuous improvement mechanisms from existing impact assessment methods. One of them is a CSRD consultant with experience working as a register accountant for a major Dutch festival holding company. The other is an environmental scientist, specialising in operational management and LCA with publications on environmental sustainability in events. The complete list of experts is found in below.

Table 4. Overview of interviewees in the sector expert (SE) and external expert (EE) stakeholder groups

Part. ID	Stakeholder category	Function	Expertise
SE1	Sector expert	CEO of a leading live sector sustainability consultancy	Events, festivals, environmental sustainability, monitoring
SE2	Sector expert	Co-founder of a sustainability advisory in the tourism, culture, and event sector	Events, monitoring, certification
SE3	Sector expert	Sustainability expert and management team at a consulting and knowledge institute for sustainable events	Events, festivals, monitoring, legislation
SE4	Sector expert	Freelance sustainability expert and board member of an event interest group in a major Dutch city	Events, festivals, environmental sustainability

SE5	Sector expert	Founder and director of a sustainability consultancy for the music and creative sector	Events, festivals, environmental sustainability
EE1	External expert	CSRD consultant	CSRD/ESRS, monitoring
EE2	External expert	Environmental scientist	LCA, environmental sustainability

Finally, the third group of stakeholders (Table 5), concerned with legislation on the environmental sustainability of festivals, permits, and subsidies consists of actors from the Dutch national government and three of the biggest municipalities in the Netherlands. Two interviews were conducted with policy officers concerned with event sustainability at the Ministries of Education, Culture and Science (Min. OCW) and Infrastructure and Water Management (Min. IenW). Three people from different municipalities (three out of four G4 municipalities), concerned with the permit process and event sustainability policy were interviewed. The rationale being that these large municipalities, boasting abundant resources, are more likely to have in place elaborate policies regarding event sustainability, stringent permit requirements, and dedicated personnel allocated to oversee these affairs.

Table 5. Overview of interviewees in the stakeholder category of governmental organisations, including actors from different municipalities (M) and the Rijksoverheid (RO), the Dutch national government

Part. ID	Stakeholder category	Function
M1	Government (municipality 1)	Coordinator urban events
M2	Government (municipality 2)	Senior advisor leisure economy
M3	Government (municipality 3)	Director event department
RO1	Government (Min. OCW)	Policy officer sustainability
RO2	Government (Min. IenW)	Policy officer market incentives

3.1.3 Addressing effectiveness

For monitoring tools to effectively address environmental sustainability at festivals, they need to provide a comprehensive account of all impacts, be utilised by practitioners, and enable users to act on the insights gained from the assessment. This section outlines how these aspects were explored through interviews, to better understand tools' efficacy in practical applications.

To ensure the tools provide an accurate and comprehensive account of festival sustainability, it is crucial to determine the scope and boundaries of the assessment in terms of both activities and impacts. Interviewees were asked to discuss the criteria they believed should guide these decisions and to identify important activities to include. Festival organisers, in particular, were queried about activities specific to their types of festivals, offering insights into the diversity of events and their unique sustainability challenges.

Additionally, festival organisers, governmental stakeholders, and participants with expertise in environmental sustainability were asked about relevant environmental impacts. They were invited to prioritise impacts and debate whether tools should report on all impact categories as defined by the ReCiPe 2016 framework for environmental LCAs (Huijbregts et al., 2017) or if a smaller selection would suffice for a comprehensive overview.

To study how monitoring tools could be effectively used by practitioners and ensure that their results lead to informed sustainability improvements, organisers were asked about their initial experiences with data collection. Questions focused on which data was easy to obtain and provided them with significant insights, aiming to help identify suitable starting points for others. The feasibility of obtaining various data types was also explored, including whether some data would currently be unrealistic to ask from organisers. Participants were further asked about the barriers festival organisers encountered regarding monitoring and in their efforts to become more sustainable. These discussions aimed to uncover practical challenges and potential solutions to enhance the usability and impact of monitoring tools in the festival sector.

3.1.4 Addressing future orientation

In considering the future orientation of monitoring tools, it is imperative not only to focus on immediate improvements and effective usage but also to envision the evolution of these tools over the next, say, 25 years. The primary objective being to ensure that festival sustainability continues to advance. This section addresses how future orientation in monitoring tools was discussed with interviewees, highlighting barriers, continuous improvement, and the role of legislation and permit requirements.

Interviewees, particularly festival organisers, were asked to identify activities they wished to include in their assessments but currently do not due to existing barriers. Discussions revolved around the types of data that are currently challenging to obtain and what future advancements would be necessary to overcome these challenges. Stakeholders were asked to provide their perspectives on how the mentioned barriers could be effectively addressed in the future. This dialogue is crucial for understanding the limitations faced by festivals today and identifying potential solutions to enhance data collection and monitoring capabilities.

Sustainability managers from leading festivals were questioned about their organisations' motivations for pursuing ambitious sustainability goals despite the lack of explicit legislative requirements. Their responses could provide valuable insights into the drivers of future orientation and the successful, continuous implementation of the Deming Cycle (Plan-Do-Check-Act). They were asked to discuss the significant role monitoring plays in their sustainability strategies and how it could inspire other organisations to follow suit. Motivations and incentives for monitoring and sustainability are discussed to gain insight in how organisations can be activated in similar ways to the frontrunners. To promote a shift from compliance to commitment, the participants are asked about measures that go beyond mere top-down regulations and penalties.

Stakeholders from governmental organisations and licensing authorities were consulted regarding current legislation and permit requirements related to environmental sustainability at festivals. They were asked to share their views on the potential evolution of these regulations and the likelihood of sustainability monitoring becoming an integral part of future policies. The discussions delved into the necessity of monitoring, contemplating whether it should become mandatory for festivals, and what such measurements would need to encompass. Additionally, the current support mechanisms in place to stimulate and facilitate festivals in their monitoring and sustainability efforts were discussed with municipal and national government representatives. This dialogue is essential for understanding how future policies could drive continuous improvement in the festival sector's sustainability performance.

3.1.5   Analysis of interviews

The interviews were recorded, and subsequently transcripts were produced from the conversations. These transcripts were coded in NVivo software (version 14.24.0) to enable thematic analysis as described in Clark et al. (2021). During transcription, any comment or answer relating to one or more of the research questions was flagged. After transcription, these flagged remarks were revisited for initial coding, where codes were created using a combination of descriptive and interpretation-focused coding strategies. When participants were very explicit and direct in their answers, the descriptive approach was applied, while sometimes answers to the questions could be found in more implicit formulations that required some level of interpretation.

With all transcripts coded, the codes were collected in containers representing the research questions they applied to. Then, per research question, codes were subdivided into two or three top-level categories after which they were reviewed in order to merge codes addressing the same concepts and create an initial understanding of themes in the data. In subsequent iterations, themes were defined for codes relating to similar ideas to subdivide all identified codes, which allowed for further grouping and organising them into multiple levels of themes

and sub-themes. The resulting themes are discussed and defined in Chapter 4, they are evidenced using quotes from participants.

3.2 Ethical Considerations

Ethical considerations will be prioritised throughout the research, including obtaining informed consent from interviewees through the program's informed consent form, which will be adapted to the specifics of this project at a later point in time. The author ensures responsible processing of data and confidentiality for participants, adhering to GDPR regulations in data management practices and adhering to ethical guidelines established by Utrecht University. For confidentiality reasons, the interview transcripts are not included in the Appendix and participants are only referred to using the non-descriptive identifiers as presented in Table 3, Table 4, and Table 5.

4 Results

The current chapter begins with presenting the results of analysis of current tools, focusing on the boundaries and scope, including the range of activities considered and the environmental impacts reported. This is followed by insights from semi-structured interviews with key stakeholders, presented through thematic analysis. High-level overviews of the analysis are presented in graphs in each of the sections. More detailed overviews of the thematic analysis can be found in Appendix B. The interview results cover the criteria for scoping and boundary setting, considerations and practicalities regarding inclusion of specific activities and impacts, and the barriers to effective monitoring and sustainability transition. Subsequently, participant insights on ways to overcome these barriers, as well as motivations and incentives for monitoring and sustainable conduct are explored. The chapter concludes with a summary of key findings.

4.1 Analysis of Current Tools

4.1.1 Activities

First, the analysis of the 15 tools focusses on the scope of their assessment in terms of the activity categories and themes that they incorporate. Figure 5 presents a high-level overview of the themes' representation in the tools. It shows that activities related to Travel and Materials are present in all tools, with the Energy theme being omitted completely only once. Most other

themes, however, are incorporated in more than half of the tools, the Digital theme, concerned with virtual events and festivals' online presence, being the only exception.

Figure 5. Overview of the presence of activity themes in current monitoring tools

When taking a closer look at the individual tools (see Table 6), there are only four that include all eight themes. These are the Green Events Tool, GDCF Monitor, Climeet, and the Planet Positive Event tool. Considering that the Digital theme is represented poorly in most of the tools, it is worth noting that the Environment-i-meter and Green Producers Tool do include all seven remaining themes. The third and last tool to include seven of the themes is TRACE, with Digital included, but not considering any Water-related activities. The myclimate tool excludes both Digital and Water, meaning six of the themes are addressed. The seven remaining tools only include four or five out of the eight themes. The themes that are omitted most often are Transport (present in 0/7), Digital (1/7), and Accommodation (3/7).

Table 6. Overview of activity themes present in the individual monitoring tools

	Energy	Travel	Transport	Water	F&B	Materials	Accom-modation	Digital	TOTAL
Climeet	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
CO2-Calculator | Events	Yes	Yes	No	No	Yes	Yes	Yes	No	5

Creative Climate Tools (CC Tools)	Yes	Yes	No	Yes	No	Yes	No	No	4
Environment-i-meter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	7
Event Carbon Calcula-tor	No	Yes	No	No	Yes	Yes	Yes	Yes	5
Event Carbon Footprint Calculator	Yes	Yes	No	No	Yes	Yes	No	No	4
GDCF Monitor (v2024)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Green Events Tool (GET)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Green Producers Tool	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	7
Milieubarometer	Yes	Yes	No	Yes	No	Yes	No	No	4
myclimate - Event cal-culator	Yes	Yes	Yes	No	Yes	Yes	Yes	No	6
Planet Positive Event	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
The Denver Eco Friendly Event CO2e Emissions Calculation Tool	Yes	Yes	No	Yes	No	Yes	No	No	4
TRACE	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	7
ZERO	Yes	Yes	No	Yes	Yes	Yes	No	No	5
TOTAL	14	15	8	10	12	15	10	6	

However, when taking a more granular look at the tools, it shows that not one of the 15 tools include all 22 activities in their methodology, as can be seen in Appendix C. Similarly, no single activity is fully represented in all tools.

Apart from the Tradewater tool that omitted the Energy theme (Figure 6) completely, the other 14 tools include at least electricity consumption from the grid. Two thirds of the tools (10/15) also consider temporary power sources such as stationary fuel combustion, with the GDCF monitor being the only one to include (renewable and non-renewable) electricity sourced from batteries. Gas consumption is present in 12 tools, but only partially covered in myclimate and the Planet Positive Event tool. The myclimate tool asks the user to input the total heated area, using this figure to estimate emissions. This approach, however, would exclude gas consumption for cooking and water heating. The Planet Positive Event tool includes LPG for temporary

power generation but does not include bottled gas or gas from the grid for other means. District heating and cooling is only covered by a minority (6/15) of the tools. All tools that do include it are based in countries where district heating and cooling networks are present (Netherlands, UK, France).

Travel (Figure 6) is a well-represented theme, especially with attendee travel being considered by all tools. Only Stimular's Milieubarometer is somewhat incomplete as it disregards travel by plane, only considering travel by foot, bike, car, touring car or public transit. Five of the tools disregard participant travel as a separate category by not explicitly requesting users to enter this data. Myclimate asks the user for input on employees only, omitting artist and supplier travel.

Transport of goods (Figure 6) is a theme which is not very well represented in this selection of monitoring tools. There are seven tools that exclude the theme in its entirety. When comparing between on-site and off-site transportation, the latter is best covered with eight tools in total including at least one way to enter this data. Six tools require Transportation data to be filled in using modality and distance. The GDCF Monitor takes a unique approach by only accepting fuel consumption data, while Climeet allows for both methods to be used. On-site transportation and building equipment are included as separate activity category in the Green Producers Tool, GDCF Monitor, and Climeet. As a result, these three are the only ones to include both on- and off-site transportation.
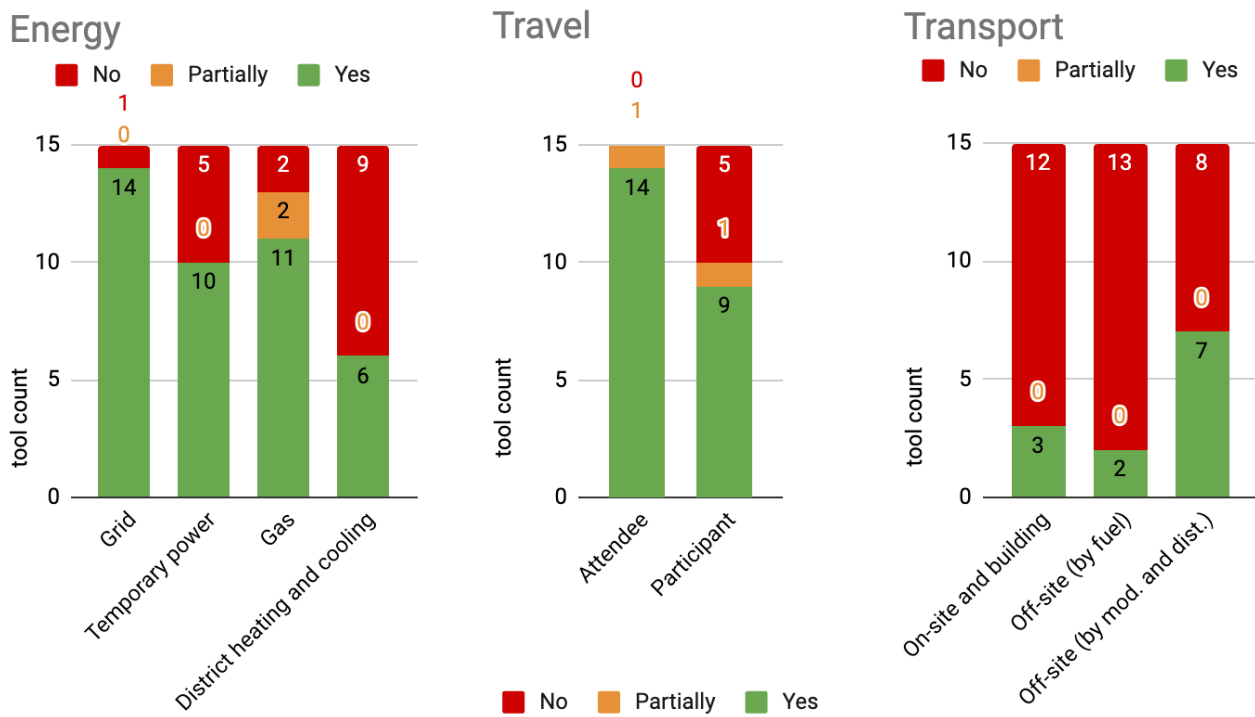

Figure 6. Presence of energy, travel, and transport activities in the tools

The Water theme (Figure 7) is omitted completely by five tools. There are three tools that include only the consumption of drinking water, while five others also consider treatment of wastewater. Environment-i-meter and the GDCF Monitor are the only tools to include all three activities of this theme, being the only tools that consider consumption of non-drinking water. Climeet is one of the most comprehensive tools in this analysis, including all activities in all other themes. However, in the Water theme it measures one out of three possible activities. Non-drinking water and wastewater treatment are not present in the tool.

The Food and beverage theme (Figure 7) is addressed in full by four tools: The Green Producers Tool, Environment-i-meter, the GDCF Monitor and TRACE, as they prompt the user to input data on food and drink consumption by both attendees and participants. At the same time, the Creative Climate Tool, Milieubarometer, and Denver's tool disregard the theme completely. Furthermore, there are five tools that include food and drinks but omit participant catering. The two remaining tools are ZERO and Climate Neutral Group's CO2 calculator. ZERO includes catering for attendees and participants but excludes beverages, while the CO2 calculator only includes attendee catering.

Within the theme about the use of Materials (Figure 7), the best represented activities are waste management and procured materials. Thirteen tools require data on their users' waste streams, with myclimate doing this to a limited extent. The tool asks their users for two metrics: total weight of residual waste and total weight of waste for recycling. The others include separate categories for recycling of different materials and distinguish between landfill and incineration for residual waste.

Regarding procured materials (Figure 7), there are four tools that only partially cover this topic. Remarkably, they all include paper. In Climate Neutral Group's CO2 calculator, it is the only material included. Stimular's Milieubarometer adds cleaning products and toners, the Environment-i-meter considers pallets and cling wrap, while myclimate, besides "printed matter", more broadly enquires about "plastics", "recyclable material (e.g. PET, glass)", and "wood, carton, paper and plant-based materials".

The only tools that include rented materials (Figure 7) are the Green Events Tool, TRACE, and Climeet. The Planet Positive Event tool asks their users to fill in the money spent on rented materials. However, upon verification with the tool developers, they clarified that this information is not considered in the carbon footprint calculations, but only used for benchmarking and other types of data analysis. TRACE and Climeet ask the user about the end-of-life of the materials, the GDCF Monitor and PPE tool do this only for tableware.
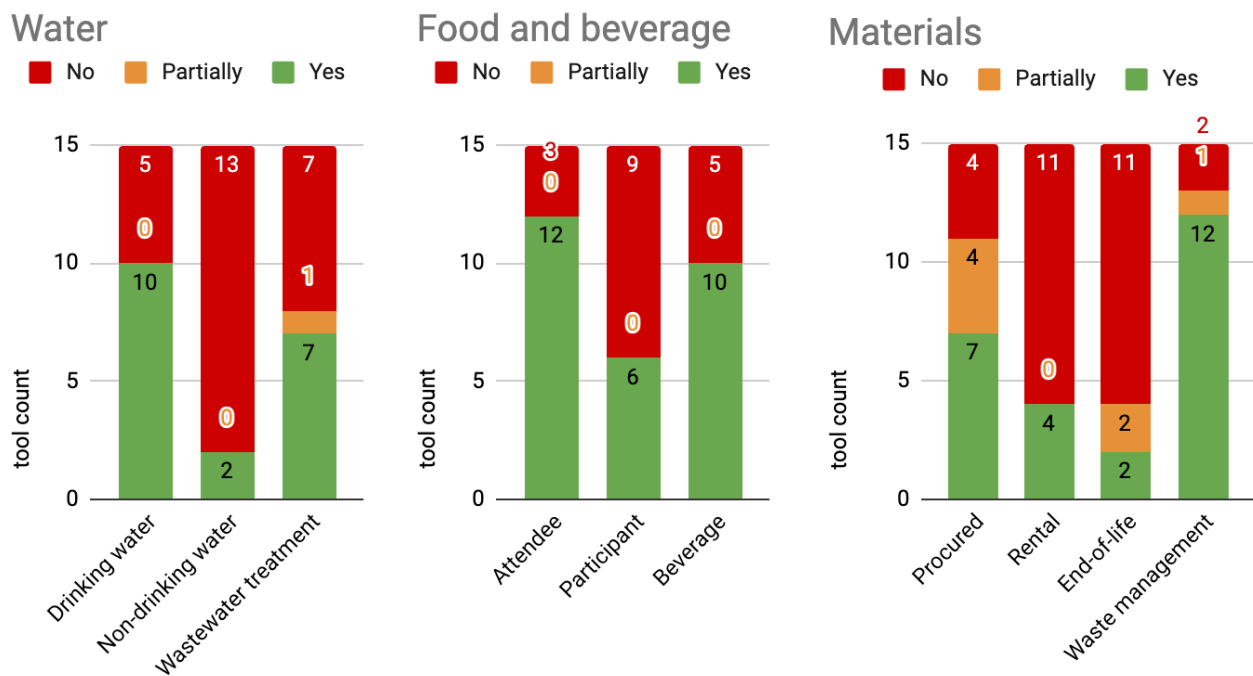
Figure 7. Presence of water, food and beverage, and materials activities in the tools

Within the Accommodation theme (Figure 8), tools are evenly spread over the different answer options. Five tools include multiple accommodation options to choose between, five tools omit the theme completely, and the remaining five include hotel nights as only option.

The Digital theme (Figure 8) is rarely covered in monitoring tools, with only six addressing it in any capacity. Climeet, as an exception, includes both the events' online presence, and activities related to hosting virtual events. The GDCF Monitor is the other tool that includes online activity. PPE also addresses this category but only covers the event's websites and social media platforms, excluding cloud storage. The three tools that, besides Climeet, pay attention to digital events are the Green Events Tool, TRACE, and Tradewater's calculator.

Figure 8. Presence of accommodation and digital activities in the tools

4.1.2 *Impacts*

The analysis of the impact categories reported by the 15 monitoring tools presents an unbalanced distribution. As can be seen in Figure 9, most of the ReCiPe 2016 midpoint impact categories are not at all covered in impact asse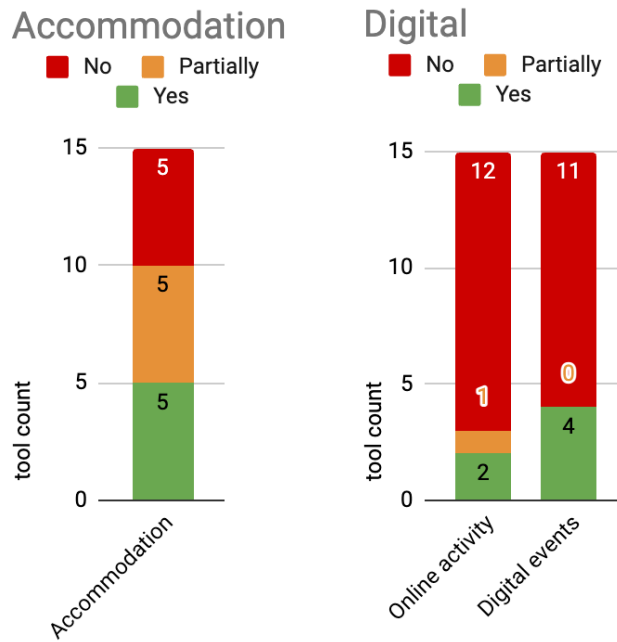ssments for festivals. The only omnipresent impact category is climate change, as all tools report on GHG or CO_2e emissions.

Another impact that some tools (partially) report on is water use. Water use as an activity category is included in most of the tools, but then, often, these metrics are not included in the final impact report. The data entered by users on water-related activities are often only used in carbon footprint calculations, focusing on GHG emissions from things like transport and treatment of the water. The three tools that do explicitly report on the water footprint of the event are the Creative Climate Tools, Environment-i-meter, and GDCF Monitor. Figure 9, however, subcategorises water use into on-site consumption of water and that which occurs in the supply chain. The three tools report the amount of water used on the festival grounds for drinking and sanitation purposes, but they do not consider the embedded water footprints related to any of the other activities. This embedded impact is considered by none of the 15 monitoring tools analysed in this research.

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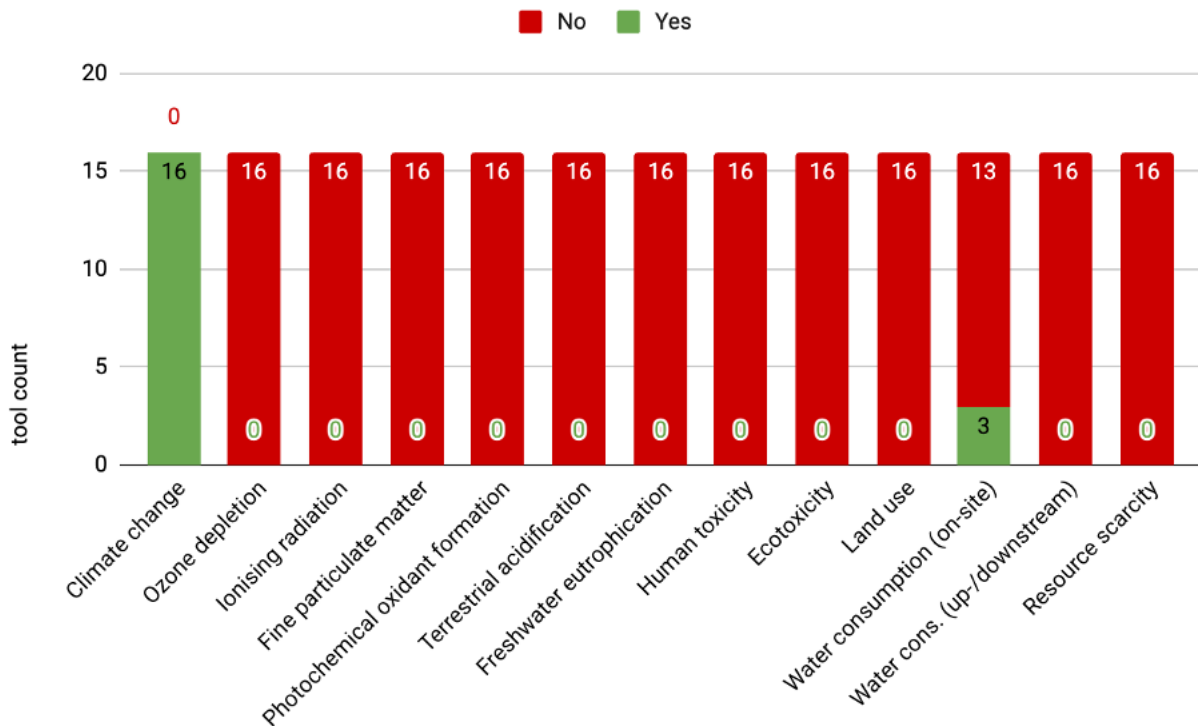
Figure 9. Overview of the impact categories that the tools report on

There are tools that, besides carbon footprint or water use, also report on waste as a separate indicator of sustainability performance. These tools include total waste generation, and the shares of residual waste and waste separated for recycling. This is not represented in Figure 9 as the ReCiPe 2016 model does not consider waste production an impact category in itself.

It is worth noting that there are some tools that consider a broader range of impacts such as local ecosystem and biodiversity impacts. However, none of them do this in a quantitative manner in the way that the selected tools do for climate change or water use. Examples of such qualitative tools are event:decision impact, Julie's Bicycle Future Festival Tools, and the Belgian groeneVENTscan. The Planet Positive Event tool also offers functionality for qualitative self-evaluation methodology besides its quantitative carbon calculator. Because of the qualitative approach, these assessments did not meet the selection criteria as defined in Section 3.1.1 and were excluded from the analysis. One tool was found that did assess carbon footprint in a quantitative manner and that claims to include broader environmental impacts too. This tool is the MyImpactTool (MIT) from Belgium, it was, however, not included in the analysis as some questions remained unanswered. Like the three tools mentioned above, the assessment of the non-carbon impact categories ('circularity score' and 'biodiversity indicator') seemed to take a qualitative approach too.

4.2 Comprehensiveness

As the previous section covered current tools and their methodologies in terms of the activities that they measure and the impacts that they report on, this section will seek to answer the question how comprehensive tools should look like. Through a total of 16 interviews with festival sustainability managers (n=4), festival sustainability experts (n=5), government officials (n=5), and sustainability assessment experts (n=2), this study has sought to explore which activity and impact categories are most relevant for assessing the environmental sustainability of a festival.

4.2.1 Boundary setting criteria

Of the 16 interviewees, eight discussed, to some extent, potential criteria for setting assessment boundaries. The most prevalent criteria being assessment goal, data availability, and event characteristics (Figure 10).
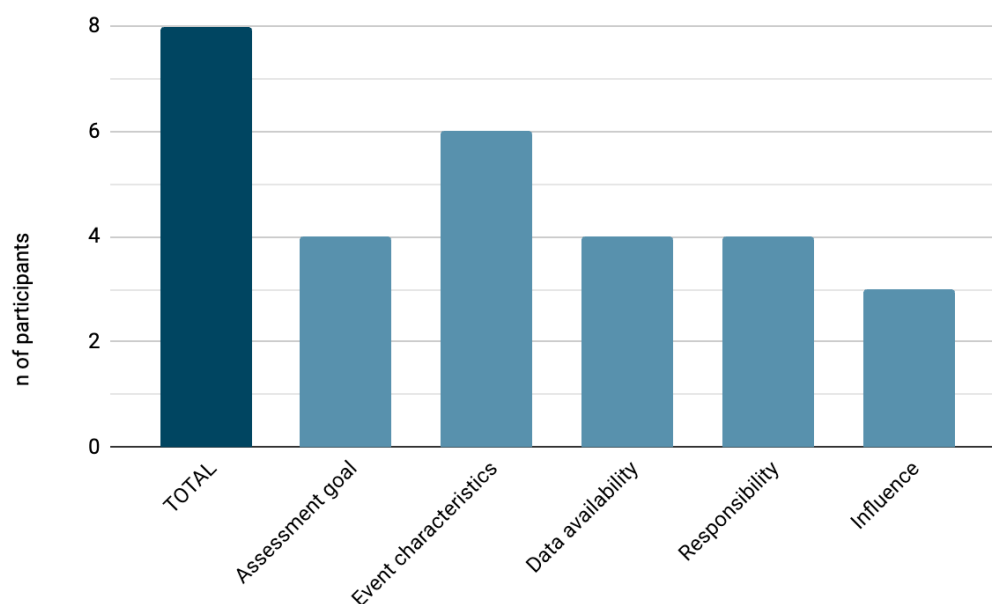

Figure 10. Thematic analysis of the boundary setting criteria for sustainability assessments

First of all, the goal of the assessment can have major implications on the design of the methodology. The goal can be to paint a complete and global picture of all environmental impacts that result from hosting a festival, then the assessment should include "all emissions and

material use that would not have happened if your festival had not taken place"[2], says participant F3. LCA researcher EE2 put it this way: "I was more interested in the total impact of the event and not about allocating this impact to the responsibility of one party or to the other". This leads to another potential goal for assessing festival impacts: to allocate impacts to the separate stakeholders in the supply chain so they can disclose this information and take responsibility. Underlying motives for this approach can be that an actor is required to compensate or pay taxes for the impacts that they are directly responsible for. This approach reduces the scope of the assessment to the impacts that the organisation can be held directly responsible for, usually limiting the activities included to only those within the own organisation or under direct financial control.

Creating the ability to assess compliance with laws and regulations can be another goal for quantifying a festival's environmental impacts. It depends on the specific policy how this would influence the system boundaries. The contents of the policy and the assumed responsibility of the organiser would determine what will have to be measured. Lastly, the monitoring exercise can also be performed for internal use. When an organisation decides to monitor their sustainability performance in order to strategically direct their efforts and means to where they can be most impactful, the scope could be limited to those activities on which the organisation can exert any kind of influence.

A widely recognised complication for setting the assessment boundaries, however, mentioned by six of the interviewees, is the heterogeneity of festivals. Which activities are relevant is to some extent dependent on the design of the festival. The presence of food consumption, on-site camping, and pyrotechnic displays were mentioned as examples of event characteristics that will not apply to all festivals. Similarly, whether a festival is fenced off and only accessible to attendees with a ticket (i.e. closed) or publicly accessible (i.e. open) has severe implications on the other boundary setting criteria such as data availability, responsibility, and influence. Similarly, festivals show variety in their organisational structures, with some outsourcing activities that are in-house operations for others. Which environmental impacts are most relevant for a specific festival depends in part on the location of a festival. Whether it is hosted in an urban or rural setting, venue-based or outdoor, in a protected nature area or a smog-ridden metropolis affects which environmental impacts the festival's stakeholders will consider most important.

Finally, other aspects that could be considered when defining the assessment boundaries would be data availability, influence, and responsibility. This would mean considering questions such as: Will the organiser be able to gather data on this activity? Does the organiser have any

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[2] Translated from original statement in Dutch: "alles wat er aan uitstoot en materiaalgebruik gebeurt dat niet zou gebeuren als jouw festival niet zou gebeuren"

influence over this activity? And finally, can the organiser be held responsible for the impacts resulting from this activity?

4.2.2   Activity categories

Activity categories were discussed in 13 of the 16 interviews. All activity themes that have been identified in Section 2.5 (i.e., Energy, Travel, Transport, Water, Food and beverage, Materials, Accommodation, and Digital) have also been mentioned in the interviews. The number of participants by which each of the themes was mentioned can be seen in Figure 11.

The Energy theme is discussed by seven participants, all confirming that this theme is relevant and should be included in any assessment. District heating and cooling, part of the previously identified activities, is not mentioned by anyone explicitly, but all other subcategories of the energy theme are. There is little controversy on whether this theme should be included or not and most participants agree on the fact that gathering data for these activities is straight forward, as invoices from power companies or generator suppliers can usually be consulted for this.
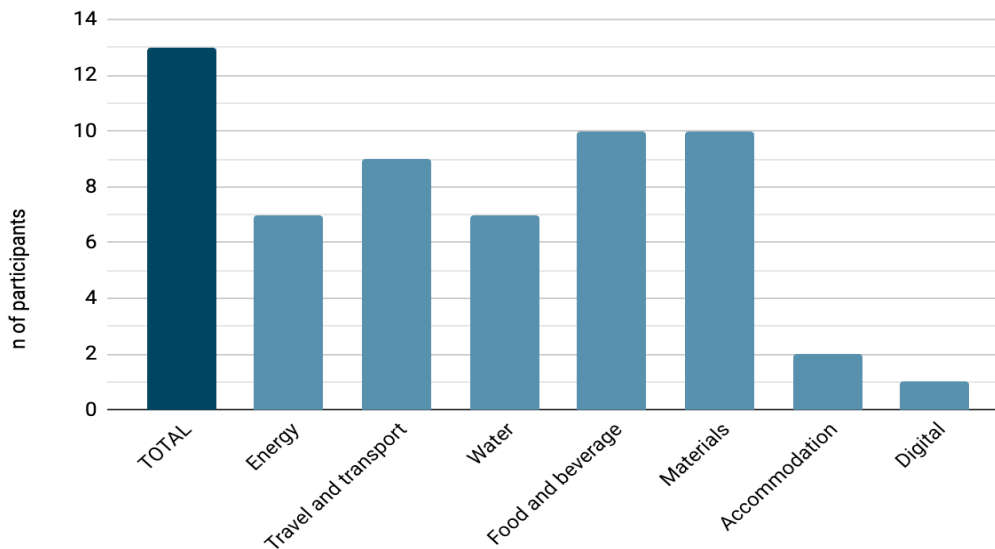
Figure 11. Thematic analysis of the activity categories mentioned by participants

Travel is considered to be a very important part of a festival's impact by eight of the interviewees, as "events are a mobility problem (…) [as most] of the impacts come from people travelling to the event", participant EE2 says. This is the case for attendee travel specifically, as participant SE1 states that "the biggest share of the [GHG] impact is audience travel". However, the relevance of travel of participants, such as crew and artists, is mentioned too. Participant F2 shares a critical note, stating that travel distances are clear and easy to obtain on the one hand, but

can be very messy on the other, with data sheets potentially encompassing travel data for up to thousands of individuals.

Four participants mention the importance of measuring transport by suppliers. In one additional case, the overarching concept of 'mobility' was used, without differentiating between travel and transport activities. However, measuring on-site transportation and building equipment is mentioned only by participant F1 who says that they include in the sustainability assessment for their festival the "transport, in the form of CO_2 and nitrogen, but also visitors, artists, production, material, so also *gators* [on-site personnel and freight transport] that are not all electric yet"[3]. Regarding data availability, participant F2 mentions the potential role for the main logistics management actor in the sector, *Festivalpoort*, who work with many of the major festivals in the Netherlands. They register and survey all incoming suppliers at the festival gate and scan the vehicles' license plates. With this data, they could easily provide all relevant data for assessing the impact of supplier transport, the participant says.

Water is another theme that is widely considered to be an essential part of any festival impact assessment. Nine of the participants either state that this theme is relevant for festivals or that it is already part of their monitoring. Three participants acknowledge explicitly that water scarcity is of growing concern for festivals. F2 says that they already measure water consumption but feel that the very low carbon footprint associated with it does not do justice to the topic's environmental significance, which is also expressed by SE1 and SE3. Participant F4, the sustainability manager of an open festival voiced another specific concern about the topic. Stating that, at their event, a lot of stages and bars are hosted by local entrepreneurs. They stated that these people generally make use of their own water connections. This makes that they did not have access to this data and cannot include it in the analysis. For most closed festivals, this would not be a problem as all water consumption can usually be metered at a central point or will be invoiced by the venue or supplier. Regarding the three subcategories, participant F1 mentions that for their flagship festival, they monitor data on all of them. The importance of the wastewater management subcategory is mentioned by participants SE3 and M2.

The Food and beverage theme is mentioned as an important aspect of a festival to monitor by 11 respondents in total. The biggest emphasis is placed on food (n=10), with drinks mentioned less often on its own (n=2), but the two are often mentioned in the same breath (n=5). The respondents mention different approaches to monitoring this kind of data. An advanced way to calculate this theme's impacts would be to dissect the festival's menus and to draft lists of the individual ingredients of every menu items. There are some festivals that take this approach, with participants F1 and F3 explaining that they apply this, participant F4 says they are

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[3] Translated from original statement in Dutch: "transport, in de vorm van CO2 en stikstof, maar ook visitors, artiesten, productie, material, du sook gators die rondrijden die nog niet allemaal elektrisch zijn"

currently rolling out this approach by having several food stands pilot the Klimato tool for food, which is also used by F3.

An easier, but less precise approach is to aggregate different menu items into higher level meal and beverage types (e.g. high, medium, low impact or red/white meat, vegetarian, vegan meals). Participant F3 suggests this approach for a more basic version of assessment for organisers less experienced in monitoring. Either way, Food and beverage, similar to Travel, is not a straight-forward entry-level theme to measure, as the activity data cannot easily be collected from a single invoice, participant F2 says. They continue, however, that with more and more festivals using digital payment systems (as opposed to cash or token systems), gathering and using this data has become much easier. Sales data can be directly exported from these systems. The importance of participant catering as a subcategory of food consumption is mentioned explicitly by one of the interviewees.

The relevance of the Food and beverage theme in terms of environmental impact is stressed by participant SE1, referring to a report showing that food and beverage together can make up up to a third of a festival's carbon footprint. Another participant discussed the paper by Cavallin Toscani (2023) on LCA's of academic conferences: Even in the extreme example of an academic conference, where the environmental impacts from travel of international attendees dominate, there are some impact categories where catering has a significant contribution. In one case, catering was the biggest contributor to land use. Often, its contribution is substantial in the marine eutrophication and water consumption impact categories (Cavallin Toscani et al., 2023).

Materials as a theme is considered to be an important aspect of the ways in which a festival affects the natural environment. Two participants mention the relevance of resources, materials, or circular economy related activities in general, with nine others talking in more detail about specific processes of material sourcing and end-of-life treatment. The theme, however, brings some diverging opinions to the surface. Participant F3 shares that in terms of incoming materials, the boundaries for the GDCF Monitor were set at newly purchased materials and products by the festival. Everything that is owned or procured by other stakeholders or reused own stock is therefore excluded. The reasons mentioned for this are data availability and double (or triple) counting of the impacts as these materials would already be part of the stakeholders' scope 3 impacts.

Participant F1 shares that at their festival they do monitor all purchased, reused, and rented materials. Participant EE2 adds to that by saying that including in the assessment the reused materials owned by the organiser themselves "makes sense" and could be quite straight forward. Applying LCA allocation rules would mean that the production impacts of these materials are divided by the number of times it would be reused at a festival. In the case of rented materials, the usage count will most likely be so high that impacts per event would be negligible. The same reasoning is used for the exclusion of rented materials in the GDCF Monitor, participant

F3 explains. This is illustrated by the example of a scaffolding tube, which, according to the participant, can be used up to thousands of times.

Items brought by attendees of the festival constitute a material-related activity category that is not presented in the proposed activity model for festivals, but that was brought up during interviews. Five participants discussed the topic, which surfaced some diverging opinions. They agree that this is a challenging activity to measure, but that it is certainly possible. This is shown by several accounts from participants (F1, SE1, SE4) of festivals where this was done through reverse engineering it from campsite waste: Collecting, sorting, and weighing campsite waste can provide information on what items were brought to and left at the festival site by attendees. Participant F3 discusses complicating factors regarding data availability, stating that it is difficult to know what others buy and that not all waste ends up in the festival's waste stream as some things will be brought home and thrown away there. Participant EE2 shares his concerns about allocation issues: "So the items brought by the attendees, OK to include them as long as they have been bought by the attendees just for – I mean, mostly for the festival. (…) [T]here are allocation issues here." Participant SE1 and SE4, however, state that festivals do have responsibility regarding these items as festivals can, for example, rent out more sustainable alternatives to current single-use party tents, they "can totally influence that".

Most participants (7/10) agree on the fact that Waste is an important category to measure. It is more straight-forward to consider then other material-related activities, as several participants state that, often, this data can just be gathered from the invoice of the contracted waste management organisation. These companies usually charge waste handling per unit of weight or per collected container. Again, however, participant F4 shares that open festivals encounter the issue that the entrepreneurs involved may contract different waste management companies, making this data more difficult to gather for the festival organiser. Additionally, as people walk in and out, bringing their own materials, food and drinks, and perhaps taking materials from the festival home or throwing it away at a location outside of the festival area, getting clear data is a big challenge for such events.

Accommodation is a theme that was not brought up particularly often in the context of which activities to measure. Only two participants explicitly addressed this activity category. Participant EE2 refers again to the academic conference LCAs performed by Cavallin Toscani et al. (Cavallin Toscani et al., 2023). Accommodation-related activities are shown to be the biggest contributors to marine eutrophication and water consumption, while making up substantial shares of freshwater eutrophication, toxicity and material resource scarcity impacts. The other participant, SE4, stated that festivals with their own on-site camping facilities should surely include this in their measurement. However, they expressed some doubts with regards to external accommodation. They acknowledged that festival organisers have influence over package deals they offer or partnerships they engage in but continues to add that organisers cannot

influence all attendees in their choices. Also, sometimes the options are simply limited, due to the supply in the area.

The Digital theme was mentioned only once by a respondent (participant F3), mentioning that it had been added to the 2024 *GDCF Monitor* input sheet for the then upcoming festival summer. They explain the reason that this "digital footprint" was added by stating that the "website use, those social views, those (…) app sessions and the Gigabytes of storage, the sent e-mails and then possibly video streaming, (…) that all happened because you are going to organise that festival."[4] Details about how this activity was implemented in the tool can be found in Section 4.1.1 presenting the results of the analysis of current tools.

4.2.3   Impact categories

Even though most of the current tools assess only festivals' impacts contributing to climate change (with the exceptional tool including water consumption to a limited extent), the experts, professionals and legislators in the event and festival sector are aware of the existence and the festival sector's contribution to many other environmental issues (Figure 12).

All eleven participants that shared some insights on which impact categories they consider relevant for festivals are of the opinion that global warming "will always be material", as it was worded by participant EE2. Regarding global warming and circular economy impacts, participant SE2 says that "that is where there are European and national objectives – regarding circularity and CO_2 reduction – and this must be measured in some way."[5]

Nine participants say that water consumption is already or will become of major importance for festivals too, not because of its carbon footprint, but because water itself is a valuable and scarce resource. Many note that water-related activities are often already part of current calculations, but that only its impacts on global warming are considered. They state that the carbon footprint of these activities is so low, that, to them, it does not do justice to the environmental issue of water scarcity

Most participants would like to see festivals report on their level of 'circularity', relating to resource consumption, but focussing on resource efficiency in a broader sense than only considering fossil and mineral resource scarcity as in done in the ReCiPe 2016 framework.

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[4] Translated from original statement in Dutch: "websitegebruik, die social views, die (…) app sessies, en de Gigabytes opslag, de verstuurde e-mails en dan eventueel de videostreaming nog, (…) dat is ook allemaal gebeurd omdat je dat festival gaat organiseren."

[5] Translated from original statement in Dutch: "daar liggen Europese en landelijke doelstellingen – rondom circulariteit en CO_2-reductie – en dat moet op éé of andere manier gemeten worden."

Participant EE2 notes that a festival's impact on mineral resource scarcity is probably low, as there is not much metal consumption, and that fossil resource scarcity likely correlates with global warming. Many participants see circular economy as an important theme as it is recognised by the European Union, Dutch Government and many municipalities as an important theme. Participants stress the importance of considering the use of resources from a circular economy perspective in a way that includes all materials, as well as the generation and treatment of waste.
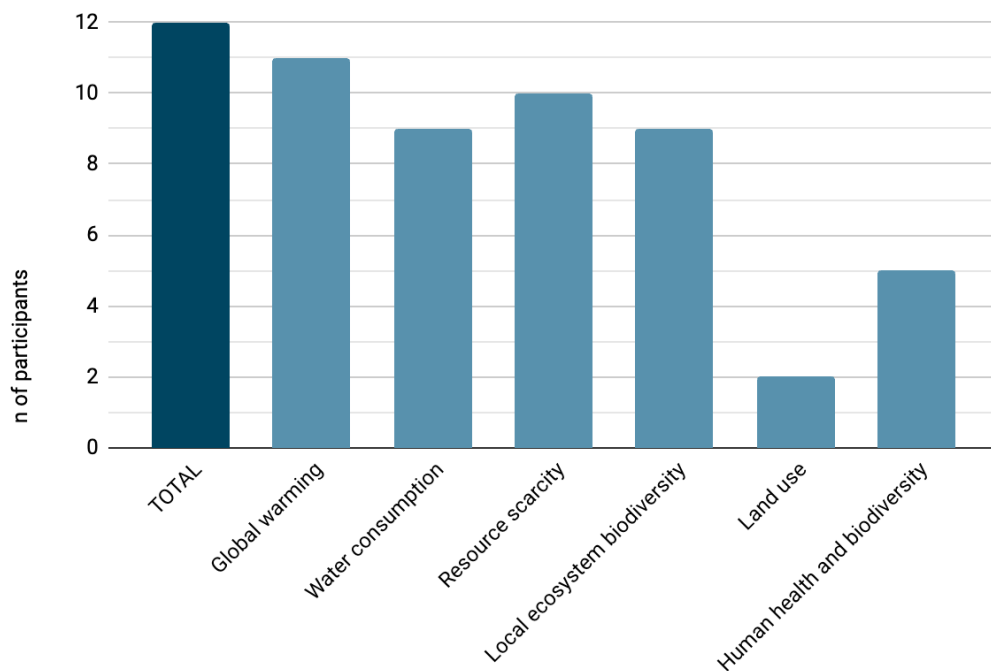
Figure 12. Overview of the thematic analysis of impact categories discussed by participants

Something else that arguably deserves more attention is the impact of festivals on the biodiversity in their local ecosystems, especially for those staged in or around protected nature areas. Participants state that these impacts are not reflected in current CO_2 calculations. However, it is also noted that they are hardly captured in an LCA. A localised EIA might be a better method to capture these impacts. But these impacts are difficult to measure and in general and participants are not sure whether this should be included in a monitoring tool.

For festivals in parks or nature reserves, measurements are already taken (because they're part of permit requirements), a mandatory ecological *quickscan* is part of the requirements for an environmental permit. Something else that has become particularly relevant in the Netherlands in recent years and is mentioned by five of the participants are the impacts (eutrophication and acidification) related to the deposition of nitrogen oxides (NO_x). By Dutch and European law, festivals close to Natura2000 reserves are required to obtain a nature permit for

which they need to assess and mitigate these impacts. Besides the fact that these impacts are already regulated, one participant argues, local effects of NO$_x$ emissions are too complicated to include in a monitoring tool. Assessments of this impact are currently performed in AERIUS, a highly sophisticated, yet still heavily criticised tool, thus not suitable for self-assessment.

Land use is an important indicator to capture the impacts of food consumption at a festival, especially as there is a potentially weak correlation with global warming. Drawing again from the LCAs of academic conferences (Cavallin Toscani et al., 2023), one participant, cautious of falsely claiming external validity, suggests that land use of a local festival might also be uncorrelated to impacts on global warming. Already currently, the impact is considered in the food impact calculator *Klimato*, which is used by some festivals, another participant states. A critique they express, however, is about the immaturity of land use data and a lack of widely accepted databases. Saying that such generic assumptions are made in these calculation factors, that most measures taken to reduce a festival's land use will not be reflected in the results.

Other impact categories that have been mentioned but that are of lesser concern to the participants are impacts on human health such as air pollution from particulate matter formation or toxicity, and biodiversity impacts such as acidification, marine and freshwater ecotoxicity, and eutrophication specifically caused by upstream activities. For example, in specific cases with large displays of fireworks and pyrotechnics, (eco)toxicity and acidification might become of concern to stakeholders. Ecotoxicity and eutrophication are impacts resulting from food consumption and accommodation, but it is suggested that these might be correlating with water consumption. Particulate matter formation is an impact primarily associated with combustion of fuels and poses a threat to human health. This impact might be of concern, for example, when a festival takes place in a city with an already particularly poor air quality or when shipping is a substantial part of the event-related activities. It is noted, however, that this impact is considered to be correlated with global warming, reducing the added value of including it in an assessment.

4.3 Barriers

4.3.1 Barriers to monitoring

So, what are the factors that keep festival organisations from monitoring their environment impacts? Participants mention a myriad of reasons for this, which can be categorised as technical barriers regarding the data and the assessment boundaries, and organisational barriers regarding motivation, resources, and capacity. Barriers to monitoring were discussed in 13 of the interviews (Figure 13).

Most importantly, getting the necessary data is difficult, as was expressed by seven of the interviewees. The data that festivals require comes from multiple different stakeholders and suppliers, which also means that they need to be gather and process this data differently. Sometimes organisations encounter resistance to their data requests or are not able to collect some of the data at all. For suppliers, the lack of a standardised approach can result in very divergent data requests from their partners.
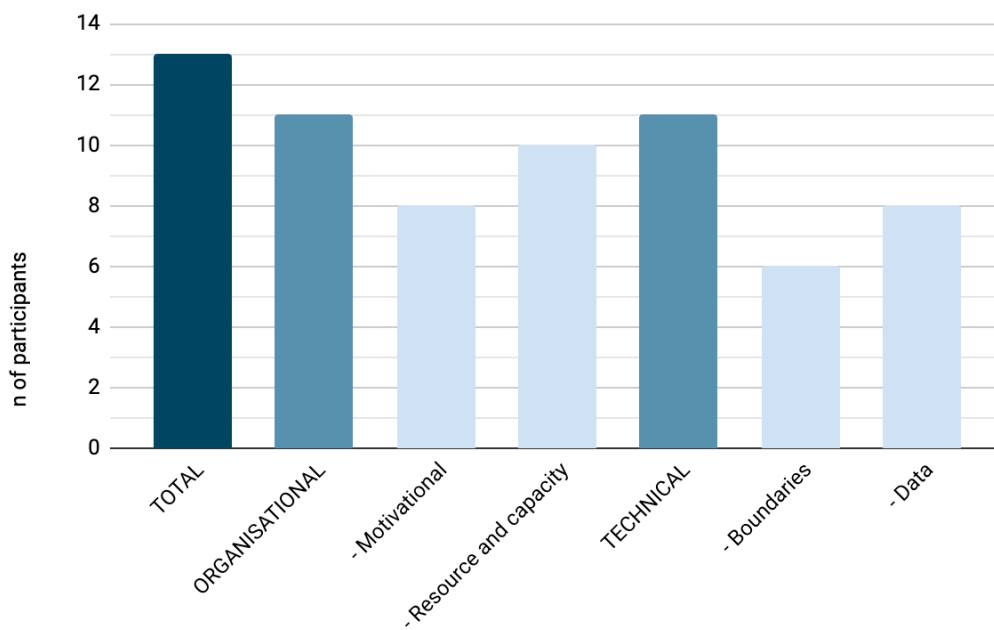
Figure 13. Overview of the thematic analysis of the barriers to monitoring

With regards to determining the assessment boundaries, the sector struggles with the fact that festivals can be so diverse, making it difficult to design a fit-for-all solution. Participants F4 and EE2 state that it can be very difficult to determine where to draw the boundaries of the assessment. The boundaries can be influenced by the organisational structure behind the festival, depending on "what the organisation team is doing, what it is outsourcing to other people". Participant EE2 further shares concerns regarding allocation issues, relevant for items brought by attendees, as was discussed in Section 4.2.2, but this also plays a role, for example, in assessing impacts of rented and reused items and materials.

In terms of the motivational barriers to monitoring, the major problem is that the process of monitoring is often conceived as uninteresting or demotivating. Practitioners are often action-oriented and lack intrinsic motivation to bother with all this data. For some, monitoring might be outside of their "comfort zone". It is also mentioned that an incentive to monitor might be missing as organisations are not yet required to do so. When there is a sense that no one else is doing it, organisations are less likely to get involved.

Many festival organisations lack the resources and capacity to be able to monitor. Reasons for this are that monitoring can be very time consuming and costly. Also, organisations lack the knowledge and skills, financial means and are already often pressed for financial means and time. This is the case especially for smaller organisations run by small teams and sometimes relying on volunteers. Even in organisations where there is intrinsic motivation and interest to start monitoring, the limited means might lead to a lower priority.

4.3.2   Barriers to sustainable behaviour

Besides barriers to start with monitoring, there are barriers that withhold festival organisations from acting more sustainably. Thirteen participants identify and discuss such barriers (Figure 14).

Lacking motivation in the festival organisations is signalled as a barrier to the sustainability transition by five participants. This can be apparent in disengaged employees or business owners without the intrinsic motivation to address environmental impacts. It might also be more nuanced, where sometimes there are sustainability ambitions, but conflicts exist with the core mission of the organisation, resulting in trade-offs between the two. There are also those organisations that are primarily financially or commercially motivated, meaning that sustainability initiatives are only undertaken when they are profitable or legally required. However, participants F3 and SE4 remark that there is currently only a limited number of sustainability-related laws and regulations in place for the festival sector, meaning that many organisations are not yet sure what will be required from them in the future. F3 adds that large, capital-intensive organisations postpone their investment decisions when it is not apparent that current or future legislation requires them to become more sustainable.

Limited capacity is an issue as well, particularly for the smaller to medium-sized festivals, four participants express. According to M1, these festivals "often do not have a professional organisation behind them, but a volunteer club that has too little knowledge and experience"[6] regarding festival sustainability. F3 adds that even when there are intrinsically motivated, sustainability-minded people in the organisation, there is often no time or budget allocated to this, or it is simply not prioritised in the organisation.

Other financial barriers that organisations are facing are financial hardship and the power relations with business owners at their holding companies and institutional investors, expressed by five and three participants respectively. Rising costs are mentioned by three participants as

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[6] Translated from original statement in Dutch: "vaak geen professionele organisatie achter hebben hangen, maar een vrijwilligersclub die te weinig kennis en ervaring hebben"

a driving force behind the festivals' financial struggles. The issue illustrated by participant SE1 who states that small festivals and events are currently facing cancellations "because they can't make ends meet because the costs have gone so much higher". Four participants worry about sustainability initiatives, F1 saying this is "the first thing that is cut back"[7]. When such decisions are imposed 'from above', festival organisations often do not have the political power to influence this. Participant SE5 explains how the decision-making by institutional investors is often determined by algorithms with the main goal of making a return on investment for their shareholders: "It's not that they're evil. It's just how the system works".
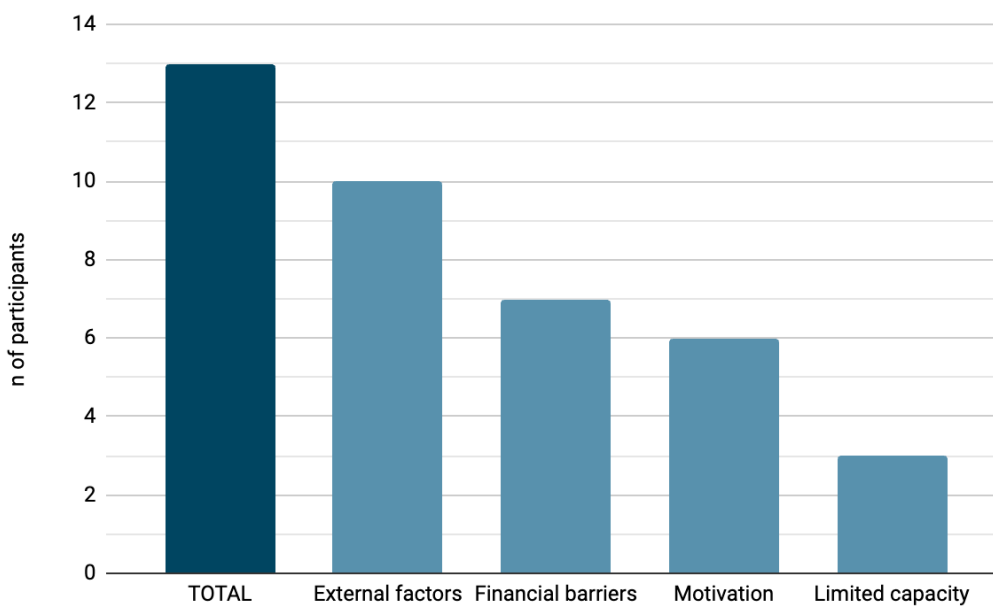
Figure 14. Overview of the thematic analysis of barriers to sustainable behaviour

In fact, there are other systemic factors withholding festivals from becoming more sustainable. Eight participants mention several factors, but they can be summed up by stating that the current economic system often disincentivises sustainable behaviour. Sustainable options are often more expensive than the 'regular' solutions. Many suppliers are not yet accustomed to offering sustainable products and services, which is exemplified by participant M3, who tells that traditional generator rental companies charge additional cleaning fees when renewable diesel is used in their generators. Similarly, as participant SE4 explains, their business models are based on maxing out generator rentals and diesel sales, pushing for redundancy and security, rather than efficiency and sustainability. Festivals' struggle with campsite waste is also exemplary of a more systemic issue, namely that of cheap, poor-quality products that "shouldn't even be sold as far as I'm concerned" (participant SE1) and the single-use, "throw-away mentality" (participant SE4). When stripped down, all these issues relate to the fact that negative

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[7] Translated from original statement in Dutch: "het eerste wat er dan weer uit bezuinigd wordt"

externalities are excluded from prices, organisational performance is still primarily evaluated based on financial value creation, and ultimately, as participant SE5 tells it, the "fundamental, inherent problem of the capitalist system that it's based on an extraction model."

The final external factors that influence the ability of festivals to become more sustainable are the availability of infrastructure and sustainable solutions at the festival's location and their dependence on external actors. According to six participants, infrastructure availability plays a role in terms of connections to the grid, water network, and sewage system, but also in terms of local waste treatment services, to name a few. Extending on this, four participants recognise that organisations have limited control over these aspects and often depend on external stake-holders such as local governments, location and venue owners, and suppliers to make the necessary changes.

4.3.3   Barriers for governments and regulators

Municipal governments are increasingly paying attention to sustainability-related aspects of the events and festivals hosted in their cities. These cities, however, take different approaches to this. For example, Amsterdam has made it mandatory for event organisers to submit a sustainability plan on predetermined topics as a part of the permit process. Rotterdam has set out sustainability ambitions but takes an approach of stimulating bottom-up initiatives. Utrecht is still in the process of shaping their policy but are considering a more middle-of-the-road scenario. They plan on continuing to offer subsidies for bottom-up initiatives, while also including sustainability as one of the four criteria to be used in the case when choices must be made regarding multiple festivals or events competing for a permit. Both the more regulatory, top-down approach and the voluntary, bottom-up way of stimulating sustainability initiatives have their barriers and risks as pointed out by eleven participants of this study (Figure 15).

For the regulatory approach, there are legal barriers and limited enforcement capacity within municipal governments, as well as concerns regarding resistance and effectiveness. Legal reasons pose limits to the sustainability requirements that can be included in permit and subsidy conditions. For example, subsidies that have been set up to promote culture must serve that goal and may not be used for other ambitions. The requirements related to the event permit are legally restricted to matters of safety.

The most prominent concern for festivals, however, is the already high regulatory burden, with legislation on hygiene, single-use plastics, required safety and mobility plans, et cetera. At the same time, four participants have their doubts about the effectiveness of imposing regulations. Regulation alone is stimulating, but not motivating, as participant F2 said, SE2 adds that regulation will not guarantee compliance. A risk of homogenous legislation for festivals, participant

M1 worries, is that it disregards the existing diversity, leading to unfair treatment. Nine participants fear that these factors could provoke resistance with festival organisations.
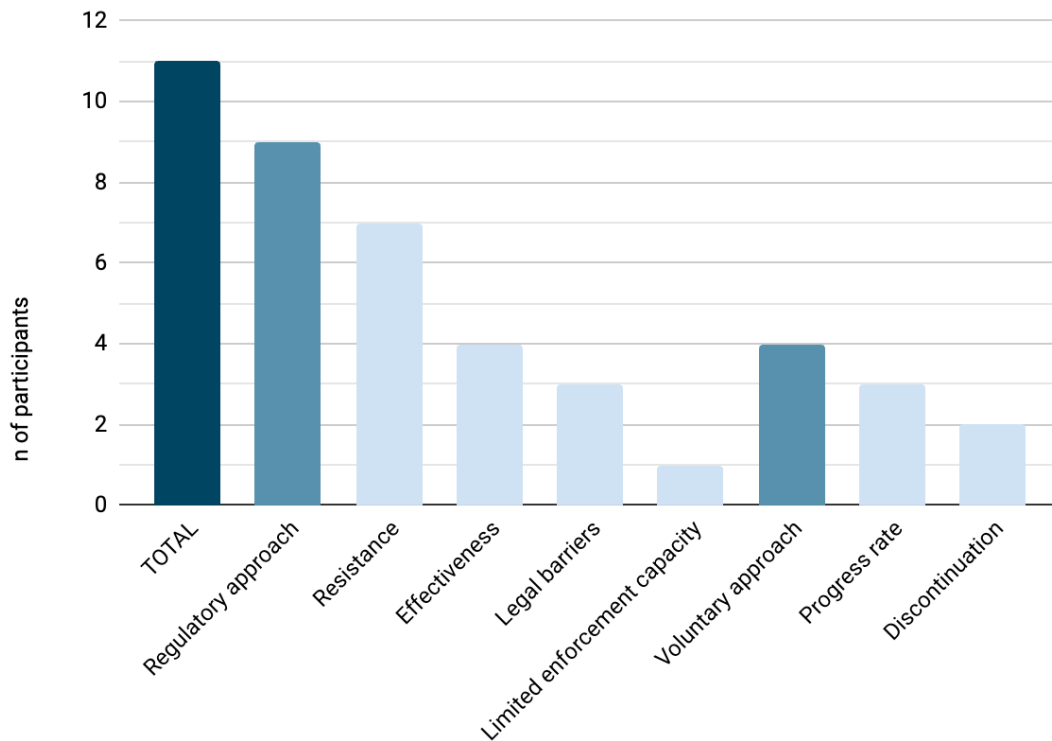
Figure 15. Overview of the thematic analysis of barriers to the regulatory and voluntary approach to policy

Problems like legal barriers, enforcement capacity, and resistance will of course not be an issue when a bottom-up approach is chosen, but effectiveness is of greater concern. Participant SE4 notes that the rate of progress, for example, is lower in Rotterdam than in Amsterdam. It is recognised by two participants that mobilising and activating organisations is more difficult in this approach. At the same time, participants M1 and M2 say that there is a greater risk of organisations dropping their sustainability initiatives when the stimulation programs are discontinued, or organisations find themselves in challenging times financially.

4.4   Future Orientation

4.4.1   *Motivations and incentives to monitor*

Fourteen out of sixteen participants discussed drivers for future orientation and continuous improvement with regards to monitoring. This section presents the motivations and incentives identified by participants (Figure 16).

For festival organisations to start monitoring, intrinsic motivation for or interest in data analysis and sustainability performance assessments would of course be a great help, but, unfortunately, this is something that is difficult to induce. Two participants explicitly recognised the need for organisations to have some sort of interest in monitoring as a prerequisite and motivation to monitoring. Five participants mention potential of internal use of the sustainability data as a reason to monitor. The results can provide insight in the progress that is being made and communicate this with the team, which is a big motivator. Similarly, it supports strategic decision-making for more effective sustainability interventions. Two of these participants mention secondary benefits of having this data, including the use of data as a tool in negotiations with suppliers and the fact that it enables data driven crowd management.
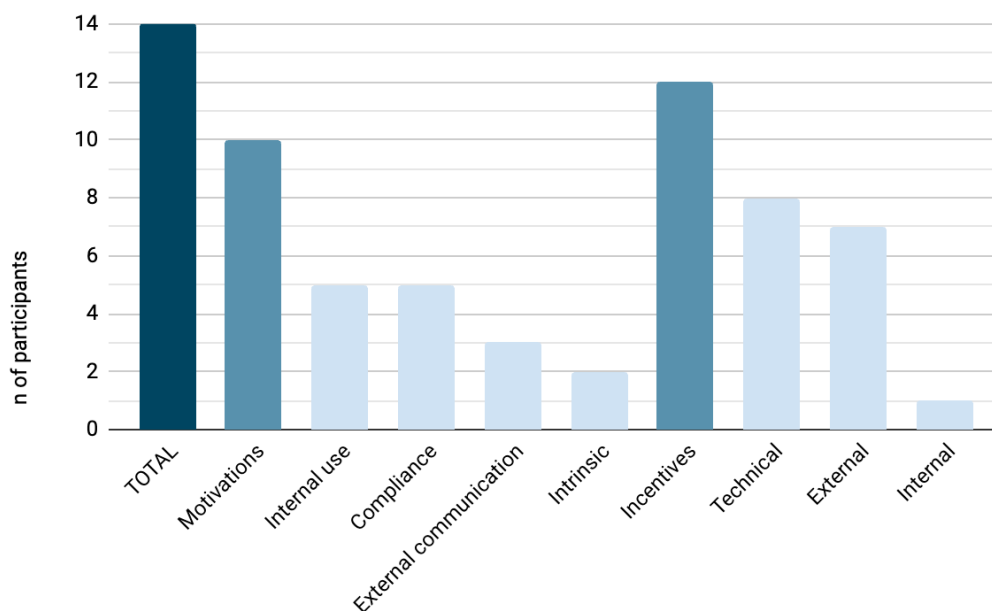
Figure 16. Overview of the thematic analysis of motivations and incentives for monitoring

The data also provides public relations opportunities as it can be used to externally communicate sustainability performance, contributing to a 'green' image. This reason is recognised by three participants. Additionally, five participants express the increasing relevance of compliance as a reason for festivals to monitor their sustainability performance. They see that more and more, it is required for festivals when they seek to obtain a permit, as prerequisite or part of result accountability for a subsidy, or a requirement in a tender for a specific site.

Twelve participants identify several ways in which organisations can be incentivised more to start monitoring. Internally, participant F2 explains, organisations can increase the incentive to monitor by making data gathering part of the job description of their employees, making it an integral part of their work. Also, increasing competence can lead to increased awareness of the

relevance, the participant argues, which advocates for organisations to facilitate this for their employees.

The strongest external incentive, mentioned by six participants, would be top-down obligation, making it legally required. Participant F3 states that much of the incentive will have to come from laws and regulations and that "if you want to impose laws and regulations, then you also have to measure, (…) measuring is simply unavoidable"[8]. Nuance to that statement is added by participant F2 saying that regulation alone "is stimulating, but not motivating. That is a very important difference"[9].

A less stringent way to stimulate organisations, mentioned by RO1, would be to normalise the use of monitoring tools by showing how other organisations are also involved or by financially rewarding organisations that monitor. Participants F3 and SE3 share that using a stepped (ladder) model is also motivating, as the first step can be something relatively simple and organisations can be rewarded and celebrated every time they reach a new level.

In terms of technical functionalities, eight participants mention that specific tool functions can create increased incentives for festival organisations to start monitoring. Three of them say tools would be more attractive if they provided insight into (potential) cost savings. Others add that it would help if sustainability performance data would be made more tangible and concrete (3/8), allowed for benchmarking against other festivals (2/8), and supported compatibility with other reporting standards (2/8).

Then, the right incentives to measure might be in place, but when organisations still experience barriers, they might not successfully complete their monitoring or even start with it at all. Thirteen participants discuss how current barriers can potentially be lowered or removed entirely (Figure 17).

To begin with, three participants stipulate a need for clear guidelines on how to set boundaries and how to measure. Participant M2 remembers from discussions with event organisers that "there was also a strong emphasis on looking to the government, like: make it clear, so the playing field is level for everyone."[10]

Capacity building is another way organisations can be made better equipped to start monitoring, the importance of which is recognised by seven participants. This empowerment can be

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[8] Translated from original statement in Dutch: "als je wet- en regelgeving op wil leggen, dan moet je dus ook gaan meten, (…) meten is gewoon onontkoombaar"

[9] Translated from original statement in Dutch: "is stimulerend, maar niet motiverend. Dat is een heel belangrijk verschil"

[10] Translated from original statement in Dutch: "er ook heel erg naar de overheden wordt gekeken van: maak het er maar duidelijk, dan is het speelveld voor iedereen gelijk."

done through direct financial support, increasing knowledge and skills of human resources by facilitating education and guidance, and by stimulating partnerships and collaborations.

A step to lower barriers that is broadly recognised, by nine participants in total, is to ensure that there is a low entry level for organisations that do not yet have any experience with these topics. For this, all nine participants agree that keeping complexity low is crucial, ensuring that the first steps are simple, while keeping the focus on what are the most important data and impacts to include. When organisations become familiar with the process, the complexity can incrementally be increased. From experience with event organisers in participant M3's work at the municipality, they suggest keeping tools affordable and time investment requirements low to ensure a low barrier to entry.
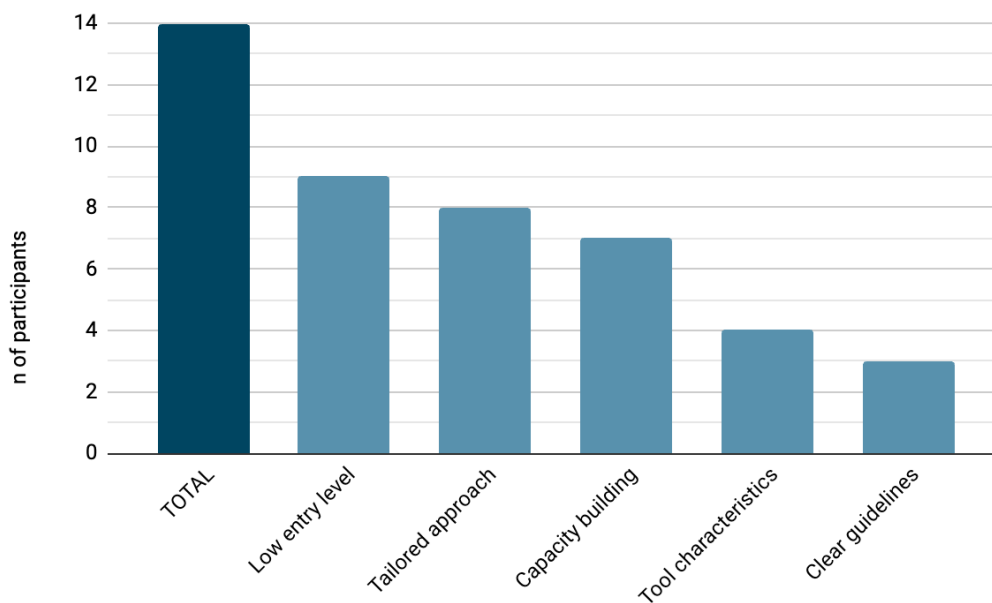
Figure 17. Overview of the thematic analysis of ways to lower the barriers to monitoring

Even though clear guidelines and standardisation are important prerequisites to lowering the barrier, eight participants stress the importance of allowing for and facilitating, to some extent, a tailored approach. Not all organisations should be pushed to start with monitoring per se. "I don't think it's necessary for everyone. (...) I'm not focused or too worried about getting a whole bunch of like 500-capacity - or fewer - events measuring their footprint or impact. They could spend that time and resource, I think, better", participant SE1 explains. Smaller organisations might be better off focusing their efforts on addressing already known pain points. "Begin with the low-hanging fruit"[11], participant SE2 agrees. Additionally, three participants argue for allowing some flexibility in the measurement approach, or in what specific data is required to suit

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[11] Translated from original statement in Dutch: "Begin met het laaghangend fruit"

the situation of the organisation. Implementing a ladder model in the monitoring approach, as mentioned before, could also provide different levels of complexity and comprehensiveness. This would allow differentiating between beginners and experts and catering to the needs of different types of festivals.

Lowering the barriers to data gathering and processing is another way in which sustainability monitoring can be made much more approachable, according to nine practitioners. Getting the necessary data into the tools would be largely simplified, if these tools would be integrated with other systems already used by practitioners in which this data is collected. For example, a lot of data is already available in planning and design software, ticketing platforms, payment systems, and supplier management software. There is also a role for these existing data partners to supply the data they gather in more ready-made formats and for developers of these tools to provide seamless integrations. Automating currently manual steps of data input and cumbersome conversions will unburden organisations and improve data quality. "So, if [these other systems] would make that calculation, it will be a lot easier for me to process"[12], F2 states. Two participants argue for the necessity of public databases of festival-related activity and impact data as those would help organisers make better assumptions and estimates if they do not have their own primary data.

Seven participants suggest ways in which the festival organisers can improve their own data gathering processes. Four argue, that beginners can make a simple start by using the data that is already available to them: "Everything for which you receive a direct invoice, so gas, electricity, litres of diesel... That is the easiest, you can always measure that"[13], F2 sums up. Participant SE1 mentions waste data as another category in this list. Additionally, organisers can simplify the data gathering process by developing organisation-wide standardised methods and by using existing systems in smart ways to reduce the number of manual actions. Participants mention optimising the use of existing stakeholder surveys, as well as payment and ticketing systems. Lastly, two participants propose to include clauses about required data in communications and contracts with suppliers.

To further lower the barriers to monitoring, four participants mention the importance of improving tool functionality and characteristics. They argue that tools should ideally meet some minimum requirements and ensure user-friendliness, ease of use and convenience, while being technically reliable.

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[12] Translated from original statement in Dutch: "Dus als jullie nou die berekening maken, dan wordt dat een stuk laagdrempeliger voor mij om te verwerken"

[13] Translated from original statement in Dutch: "Alles waar je een directe factuur van krijgt, dus gas, elektra, liters diesel... Dat is makkelijkste, dat kan je altijd meten"

4.4.2 Motivations and incentives to sustainable behaviour

Monitoring alone does not make a festival more sustainable. To ensure that festival organisations become future oriented and engage in continuous improvement of their environmental sustainability, the right motivations and incentives for this behaviour need to be in place. This issue is addressed by 14 participants (Figure 18).

Again, one of the ways in which this transition can be facilitated is through capacity building, seven participants argue. Six of them state that one aspect of this is to ensure that knowledge is created and shared and that organisers are provided with guidance during the process. Five participants stress the need for financial support from governments and the role these governments should play by incurring additional costs of sustainable options, taking on the financial risk, or setting up subsidies. Two participants discuss how stakeholders can contribute to strengthening the existing ecosystem by bringing together different parties, including frontrunners and parties from outside the network.
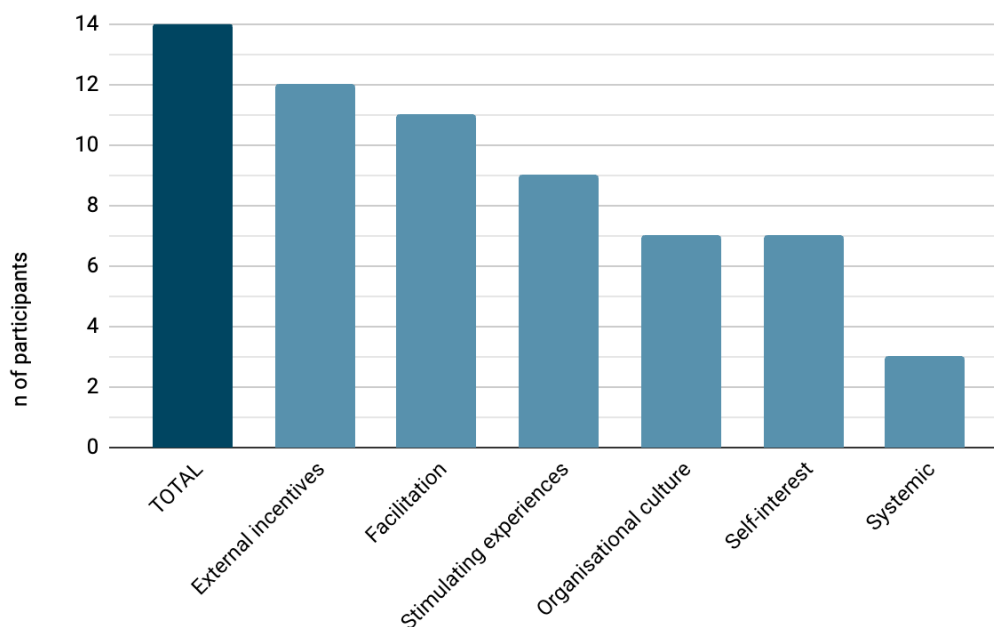
Figure 18. Overview of the thematic analysis of motivations for sustainable behaviour

Other ways to facilitate are through development of infrastructure and making sure that organisations are given enough time to adapt and transition, underlined by three and two participants respectively.

Twelve participants discuss the role of external incentives to improve the sustainability of the sector. These external incentives can be emplaced by governments in the form of regulations

and concrete medium and long-term goals for the festival sector, following a clear and well-defined future perspective. Prospects of an external audit can work well to activate both the own organisation and suppliers. Stakeholders such as audiences and funds demanding more sustainable behaviour also provide an external incentive. Other ways to incentivise organisations to adopt change are through nudging or rewarding of sustainable behaviour.

Positive and stimulating experiences strengthen the cycle of continuous improvement, according to eight participants. Examples are the experiences of validation and competition, which can be induced through awards and rewarding. A sense of purpose can be instigated by being part of a bigger movement or having lasting positive impact. Having success experiences by addressing low hanging fruits, like simple and no-cost interventions can help to build confidence and feed into a sense of mastery. Seeing successful examples from others can help increase confidence too. Feeling to be in charge and being able to make your own decisions, a sense of autonomy, is another motivating experience.

Organisational culture also plays a major role in an organisation's motivations for behaving sustainably, seven participants enunciated. Again, intrinsic motivation is mentioned as an important factor here, as well as having an organisational vision and organisation-wide sustainability goals and targets. These ambitions can be institutionalised through budget allocation, including it in performance assessments, or creating economic incentives such as internal carbon pricing. Building bottom-up support in an organisation can be done by actively involving employees, using positive communication to encourage and convey enthusiasm. Some organisations are increasing employees' sense of responsibility by making them aware of their role in the organisation's sustainability performance and using the data to set challenges and hold them accountable. The sustainability department facilitate employees by providing guidance, help, and support and by tailoring the ambitions to the needs and interests of the employees.

Seven participants share how organisations can also be motivated by playing into their self-interests. For some organisations, addressing environmental impacts is a form of risk management, while others can be economically motivated to appeal to a 'green' audience or reduce costs. Participant F1 reported that the frontrunner position of their festival has rewarded them several privileges within the municipality, including benefits in the permit process, access to subsidies, attracting new partnerships, and being to help shape municipal policy.

5 Discussion

In the upcoming sections, the main findings of this study are discussed, weaving together the results obtained through analysis of current tools and interviews with sector professionals. The findings are interpreted and contrasted with previous scientific work and academic theory. The

limitations of this study are acknowledged. Practical applications of the study's findings are formulated by translating the main insights into actionable recommendations. The chapter concludes with suggestions for future research and how it could build on the current findings or seek to consolidate them by addressing this study's limitations.

5.1 Discussion of the Results

5.1.1 Boundary setting criteria

The findings from the interviews highlight several critical criteria for setting assessment boundaries in monitoring the environmental impacts of festivals. The most prevalent criteria – assessment goal, data availability, and event characteristics – provide a comprehensive framework for understanding how to design effective and targeted sustainability assessments.

The goal of the assessment profoundly influences the scope and methodology. In this study, the assumed goal of the monitoring enterprise is to paint a complete and global picture of all environmental impacts that result from hosting a festival. Taking this approach means including all activities and impacts that would not have occurred had the festival not been organised. If the aim is to capture a complete picture of all environmental impacts resulting from a festival, the boundaries must be extensive, including all inputs into the system and emissions and other outputs and wastes that would not have occurred without the event. Conversely, if the goal is to allocate impacts to specific stakeholders for responsibility and accountability, the scope narrows, focusing on activities directly under the organisation's control. The latter is often applied by current practitioners and tools in the festival sector, as they follow guidelines developed primarily with a focus on the organisational perspective. Double counting of emissions or impacts is a concern when allocation is the goal.

However, as pointed out by Cavallin Toscani et al. (2022) and explained in the *Net Zero Carbon Events* (NZCE) measurement method documentation (Aggarwal et al., 2023), a product or service perspective is better suited for events – such as festivals – as this takes into account the entire life cycle, encompassing all stages of event production as defined by Boggia et al. (2018). Allocating impacts might serve a purpose, but in the festival sector, with such heterogeneity in event characteristics, organisational structures, a focus only on the activities under an organisation's direct (financial) control or responsibility would not achieve the goal of having comprehensive and comparable results. With the ambition of having effective monitoring tools that actually contribute to holistically sustainable festivals considering ALL environmental impacts, it is crucial to consider all festival-related activities and all ways in which these affect the environment. A comprehensive, life cycle perspective is essential for effectively achieving sustainability, especially in a sector as heterogeneous as festivals.

5.1.2   Activities

During this study, the analysis of 15 monitoring tools and interviews with 16 festival sustainability managers, governmental organisations, regulators, and special interest groups provided valuable insights into the key activity categories to consider when assessing the environmental impacts of festivals. The findings highlight both the commonalities and variances in current practices and underscore the complexity of comprehensive environmental monitoring in this sector.

Energy usage is unanimously considered a critical component in environmental assessments. Most tools already include energy consumption metrics for grid electricity, temporary generation, and natural gas, corresponding its presence in the literature [SOURCES]. The data for these categories are typically accessible through invoices from grid operators or suppliers of generators and batteries. However, district heating and cooling are rarely mentioned by participants and are absent from most tools. There are exceptions, with some tools from the Netherlands, the UK, and France – all countries with district heating or cooling grids – including this, as is the case for a tool developed by the UN. Interestingly, the PPE tool from Slovenia also includes it, but it does not include gas consumption from the grid, while a gas grid is also present in the country. The Nordic Green Producers Tool does not include district heating and cooling, even though it is a common source of heat in Scandinavian countries. The tool's primary focus on movie sets and outdoor festivals might explain the omission, as these activities are not often venue based. While adding this functionality would be relatively low effort, the relevance to festivals is arguably low.

Travel, particularly attendee and participant travel, is included in all monitoring tools and is widely acknowledged in literature and by participants as a significant source of greenhouse gas emissions. Despite its importance, measuring travel-related impacts is challenging due to the high number of stakeholders from which the data needs to be collected and because it often needs to be aggregated and pre-processed before it can be used in a tool. However, online ticketing systems can facilitate this data collection. Section 5.1.4 dives deeper into how this process can be simplified further. Additionally, while some tools aggregate all travel data, explicitly distinguishing between participant and attendee travel will ensure that users will enter data for both categories. This way, there is no chance for accidental omissions of one of the categories, which can enhance benchmarking, while also allowing for more granular and precise and impact assessments.

Transport, especially off-site transport, is included in just over half of the tools, with on-site transportation even less frequently addressed. Tools employ different methods for calculating impacts, with some tools relying on calculations using modality and distance information and

others on fuel consumption data. Although the latter approach provides a more accurate measure of environmental impact, it is notably more data-intensive.

In many tools, on-site transportation is not treated as a separate activity category, meaning that – when it is considered – it will be aggregated under broader energy consumption metrics. Segregating these activities would necessitate additional effort to measure the energy consumption separately. Despite the limited explicit mention of transportation in interviews, participants implicitly recognise the broader mobility theme, suggesting its inclusion in environmental assessments is necessary but challenging due to the diversity and complexity of data sources required to accurately capture these impacts.

The study indicates that to comprehensively evaluate and mitigate the environmental impacts of festivals, future research and tool development should focus on improving data collection methods for transportation-related activities. This includes enhancing the granularity and accuracy of data for both off-site and on-site transport. By developing more sophisticated and user-friendly tools that can integrate diverse data sources, festivals can better understand and manage their transportation impacts, ultimately contributing to more sustainable mobility.

Water usage emerged as a critical concern among participants, with water scarcity highlighted as a pressing future issue. Although two-thirds of the tools include water consumption metrics, the extent of the coverage varies considerably. Drinking water data is more readily available through supplier invoices, while wastewater treatment data can be more elusive. Data availability depends on whether it is trucked off-site, treated on-site, released into the sewage system, or discharged into the environment. With the predominant focus of tools on GHG emissions, the relatively low carbon footprint of water consumption and treatment could be a factor behind the category's limited presence in tools. This reasoning, at least, has led to the exclusion of water supply and distribution activities from the NZCE Measurement Methodology (Aggarwal et al., 2023). However, wastewater that is not treated sufficiently, leaks from poorly installed temporary sanitation units – which, unfortunately, occurs often at festival – or is even actively discharged directly into open water bodies, will have significant environmental effects on local ecosystems that will never be captured by a carbon footprint. Additionally, the usage of non-drinking water, has also been identified by Boggia et al. (2018) as a relevant activity for events. The fact that is still excluded in many tools, illustrates a persisting gap between academic research and practice.

The Food and beverage theme is undeniably significant in assessing the environmental impacts of festivals. Both literature and participant interviews highlight that food, in particular, contributes substantially to a festival's overall impact. The importance of food and beverage impacts varies depending on the nature of the festival. For instance, a family-oriented daytime food truck festival will have a different culinary profile from a nightly music festival where food consumption will be drastically lower, but (alcoholic) beverages will play a more prominent role.

The culinary profile of the festival will also influence the types of meals and beverages served, with "high value serviced food" or "take-aways" having different supply chain and waste impacts (C. Jones, 2008). Although, impacts resulting from additional waste for take-away foods will show up, in the material theme, differences in supply chain impacts might not, signalling the need for sophisticated tools not to settle on only high-level categorisations of food and beverage menus. Sufficient detail is needed in the assessment to capture effects of, for example, sourcing locally grown and organic foods as opposed to less sustainable options that might not necessarily be reflected in such generalisations.

Participant interviews reveal that measuring the impacts of food and drinks is crucial, yet it is often less straightforward than other categories. The contribution of catering to environmental impact can be substantial, with one study showing that – expressed in global hectares – catering can account for more than 60% of a festival's total ecological footprint (Andersson et al., 2013). However, festivals often face challenges in obtaining detailed data, particularly when multiple caterers are involved. Participant and attendee catering are usually provided by different vendors, and separating these categories is essential for accurate measurement and meaningful benchmarking. This differentiation also enables festival organisers to identify specific areas for improvement and more effectively manage their sustainability initiatives.

Despite the clear relevance of the food and beverage category, the extent of its inclusion in monitoring tools varies. Some tools may simplify or aggregate data, potentially overlooking nuances in environmental impacts (such as the effects of sourcing organic foodstuffs when the tool aggregates meal types based only on carbon footprint) of their different menu items. Others take a more granular approach by reporting all beverages separately and dissecting their menus to the level of individual ingredients. The first approach might be more suitable for smaller or less-experienced organisations to get quick, high-level insights, while the other is more comprehensive and might provide more detailed and meaningful information to the experienced professional. Future tools, however, should always strive for the most comprehensive and complete assessment, especially as data availability will only improve in coming years and practitioners will grow used to assessment processes like this.

Waste management is a critical focus in the environmental assessment of festivals, well-represented in both monitoring tools and academic sources on festivals specifically (Andersson et al., 2013; Andersson & Lundberg, 2013) and events more generally (Boggia et al., 2018; Cavallin Toscani et al., 2022; M. Jones, 2014; Raj & Musgrave, 2009; Sherwood, 2007). Participants emphasised the importance of waste, particularly given the increasing attention to the topic of circularity by governments. Data availability for waste is generally not an issue for closed festivals, where waste streams are clearly defined and managed. However, there are limitations in data accuracy, especially for open festivals where waste treatment partners may be contracted indirectly, leading to challenges in allocating waste specifically to the festival.

Despite the emphasis on waste, the procurement of materials is notably underrepresented in monitoring tools. This discrepancy may be attributed to the relatively low carbon impact of materials compared to other activities or the complexity of data collection. Many materials used at festivals are rented, which can complicate the measurement of their environmental impact. The lifecycle impacts of rented materials, when divided by their usage counts, are often assumed to be insignificant. However, a member of the *Events & Cultural Spaces Working Group* of the *Carbon Accounting Alliance* (CAA), who recently calculated emissions related to the rental of a large audiovisual installation indicated that the embodied emissions proved to be significant, even life span and usage count were accounted, advocating for the inclusion of rental impacts in environmental assessments. Accurate life cycle assessments and data sharing from hire companies are essential to validate these assumptions and to enable inclusion of these impacts in monitoring. This is crucial as, indeed, rented materials still inflict negative effects on the environment. If these impacts are not considered, practitioners will not be incentivised to opt for more sustainable rentals. Besides, it is likely that practitioners currently underestimate impacts from rented materials. Many participants mentioned they assume the impacts to be practically negligible, however, as illustrated in the example from the CAA and taking into account that festivals are increasingly using highly technical installations for their shows and using massive battery installations, for example, these impacts might actually have significant contributions to the festivals' up- and downstream sustainability.

Other potentially significant impacts arise from the materials brought by attendees, especially at festivals with on-site camping where single-use items (e.g. (party) tents, air mattresses) are common. These materials are included in the waste measurements, but their upstream impacts are not accounted for in any current tools. This oversight is critical, as it fails to capture the full environmental footprint of the festival. Attendees' disposable items that are discarded outside festival grounds further complicate waste data accuracy. Although standard approaches might exclude these impacts as they fall into the 'scope 3 of the festival's scope 3', several participants argued that festivals have the ability to influence attendee behaviour and should thus take responsibility for these impacts.

Furthermore, the integration of waste management practices does not fully address circularity-related issues. While the focus on waste aligns with governmental priorities (Rijksoverheid (Dutch Government), 2020), the exclusion of upstream material impacts, such as procurement and attendee-brought items, highlights a gap between research and practical application. In the literature, the importance of material production and sustainable sourcing for events is expressed by several authors (Boggia et al., 2018; Cavallin Toscani et al., 2022; M. Jones, 2014). This gap is exacerbated by the fact that many tools are developed primarily for events or office-based companies rather than festivals specifically. For example, outdoor festivals, which often involve temporary structures and large-scale setups, face unique material consumption challenges not typically encountered in indoor or corporate events.

Overall, the materials category in festival environmental assessments requires a more comprehensive approach. Future research should focus on integrating procurement impacts, accurately measuring the lifecycle impacts of rented materials, and addressing the upstream impacts and data gathering challenges related to attendee-brought items.

5.1.3   Impacts

The most remarkable finding in terms of the environmental impacts addressed by current sustainability assessment tools for festivals surely is the fact that Figure 9 is almost entirely red. The fact that current tools assess GHG emissions almost exclusively is an important sign that festivals are currently not addressing environmental sustainability in a holistic and comprehensive manner. As almost no tools include quantitative assessments of impacts other than climate change, but that they are sometimes assessed in more qualitative manners, the question arises whether these impacts can be quantified at all. However, methods such as EIA and LCA, ecological footprinting in environmental science prove that this - even though each of these methods of course has its limitations - is possible. Future research should focus on how the quantitative approaches of these methods can contribute to more comprehensive environmental impact assessments for festivals. Assessments that actually provide a complete picture of festivals' effects on the Earth system, including ecology and human health impacts.

Arguably, climate change is the most pressing environmental concern of the current time. This is reflected by the unanimous support of the interviewees for including it in sustainability tools and the fact that GHG emissions are reported in all but one of the analysed tools. However, the pressing threat of climate change is not the only environmental challenge that live on Earth is currently facing. Despite the increasing public awareness of concepts like the circular economy, and environmental issues such as water scarcity, and biodiversity loss, these concerns are not yet fully reflected in existing tools, which predominantly focus on GHG emissions.

Laurent et al. (2012) suggest that, unless the carbon footprint is proven to be a good indicator for the overall environmental impact of a product or service, it should be used merely as a 'transition indicator'—a preliminary step towards more holistic approaches. Cavallin Toscani et al. (2012) argue that GHG data can potentially be a good compromise for more comprehensive assessment, citing a case study on a music concert where the carbon footprint was a good indicator of the total environmental impact. However, this correlation needs further testing to ensure its validity for festivals.

Another study on the life cycle impacts of an academic conference, performed by the same main author, suggests that there is limited correlation between global warming on the one hand and toxicity, eutrophication, land use, and water consumption on the other hand (Cavallin Toscani et al., 2024). These impacts were mainly contributed to activities other than

stakeholder transport, namely accommodation and catering. These activity categories have limited to no presence in a music concert but will be important for many festivals. Similarly, Laurent et al. (2012) identify categories with limited correlation to global warming, such as toxicity to ecosystems and humans, depletion of resources, and land use. Notably, the water consumption impact category was not considered in their analysis.

While carbon footprinting provides a starting point, other impact categories should ideally be included to provide a more comprehensive environmental assessment. Full-scale LCAs are time and resource-intensive, but an LCA approach limited to climate change alone, as suggested by Cavallin Toscani et al. (2022) does miss significant impacts in other areas. Undoubtedly, there are other categories that will prove to be relevant for festivals and should be added to current carbon accounting tools to create a more holistic picture of a festival's environmental impacts. Which impacts exactly are most significant for festivals might differ per festival, but global warming cannot provide a complete picture.

Laurent et al. (2012) propose that when correlations between impact categories are observed, scaling factors can help predict the magnitude of other impacts based on the carbon footprint. This approach could provide basic insights into environmental impacts beyond climate change without much additional effort from tool users. However, this data is currently unavailable, indicating a need for future research to perform and analyse LCAs for festivals to understand how impact categories relate. This approach might provide a useful interim step towards fully holistic assessments, as proxies like this will not be able to tell the complete and nuanced story in every occasion.

Additionally, one interviewee hypothesised that, in the study by Cavallin Toscani et al. (2023), the impacts of eutrophication and ecotoxicity are somewhat correlated with water consumption. This suggests that considering only the three remaining impact categories, being global warming, land use, and water consumption, might result in a reasonable approximation of the festival's total environmental impact already. Although considering these three impacts will not provide a complete insight into a festival's environmental impacts, it will significantly enhance the comprehensiveness of the assessment compared to focusing solely on global warming, resulting in a more holistic consideration of environmental sustainability, mitigating risks of problem shifting.

In the thematic analysis of the interviews with sector professionals, global warming, water, impacts related to circular economy (i.e., waste generation, recycling shares) and local biodiversity impacts receive most attention. The fact that human health, and upstream biodiversity and land use impacts are not discussed as much could find its explanation in the fact that festival organisations traditionally focused on local impacts primarily. Global environmental concerns are not yet institutionalised in permit processes managed by local authorities. Current permits, required by law through policies such as the *Wet Natuurbescherming* (Nature Conservation

Law), *Natuurvergunning* (Nature Permit), and *Omgevingswet* (Environmental Code) mainly address local ecological impacts, NO_x emissions, and other local and social issues such as safety, mobility, and local water and noise pollution, respectively. This focus is gradually shifting with international regulations, such as the European ban on single-use plastics and global climate goals. The growing traction of GHG accounting represents a shift towards considering the upstream consequences of decisions, marking a significant change from the traditional scope. This development paves the way for inclusion of other regional, national, or global environmental impacts, occurring because of activities up- and downstream in the festival value chain.

Water is one impact category included in some existing tools, reflecting participants' views that water scarcity is an increasingly important issue. However, these tools typically only account for on-site water consumption, often limited to drinking water, and ignore upstream and downstream water footprints. To provide a complete insight into a festival's water consumption, tools should include the three components that comprise the water footprint: blue, green, and grey water consumption (Hoekstra, 2019) across the entire lifecycle of festival-related activities. Hoekstra (2019) identifies electricity generation, production of materials like cotton and paper, and agricultural products as some of the big contributors to water footprint. All of which, to varying extents, can be part of festival-related activities, solidifying its relevance as an impact indicator for festivals.

As discussed previously, local biodiversity impacts can be of relevance to festival organisations. However, assessing such effects using a high-level monitoring tool is challenging. Biodiversity assessments as part of the permit process always include physical site visits and are performed by professional biologists. These studies could not be emulated by some digital monitoring tool. Besides, the added value of such functionality in a monitoring tool is questionable, as these assessments are already institutionalised and regulated to some extent. Given the difficulty of quantifying these impacts with basic activity data, and the existing regulatory frameworks, it might be unnecessary for sustainability monitoring tools to address these impacts.

The key conclusions from this section emphasise the need for a more comprehensive approach to environmental sustainability assessments for festivals. Current tools predominantly focus on GHG emissions, which, while important, do not capture the full range of environmental impacts such as water use, biodiversity, and circular economy aspects. Future research should aim to integrate broader environmental impact categories into assessment tools, leveraging methodologies like LCA to provide a holistic view. This approach will help ensure that festivals can address and mitigate a wider array of environmental challenges, moving beyond a narrow focus on climate change.

5.1.4   Conditions for effectiveness and continuous improvement

The main findings of this study regarding the conditions for continuous improvement of festival sustainability relate to barriers, motivations, and incentives. Participants discussed the barriers that festival organisers experience or perceive with regards to monitoring and transitioning to environmental sustainability. They also discussed the struggles that governments and regulators face in their efforts to stimulate and accelerate this transition, especially concerning the choice between mandatory and voluntary pathways. Counterbalances to these barriers were identified by focusing on possible motivations that festivals might have to start monitoring and start acting more sustainably. Lastly, participants shared additional incentives that can be put in place to further enforce the cycle of continuous improvement.

Regulation is a straightforward way to increase incentives for sustainable practices, but it does not inherently build motivation and may lead to resistance. Genuine motivation arises from awareness of the necessity for transitioning. This awareness can be fostered through education and, more importantly, by providing clarity and guidance about future requirements, including legislation and permit needs. Organisations that know where things are headed can set plans, allocate resources, educate employees, and make necessary investments.

Governments play a pivotal role in setting out goals and targets for the sector, creating a level playing field and justifying investment decisions. This corresponds with the 'guidance of the search' function, crucial for the development and adoption of innovations, as shown by Hekkert et al. (2007). Additionally, frontrunners and special interest groups can act as accelerators by lobbying with governments for ambitious goals, further driving the sector towards sustainability. The importance of these dynamics is also demonstrated in the TIS theory (Hekkert et al., 2007).

To monitor and improve sustainability, organisations need adequate capacity. This involves ensuring festival organisations have access to necessary information, skills, and resources. Networks and partnerships can facilitate knowledge sharing and normalise sustainable practices. Employing dedicated sustainability personnel and investing in their education is essential. Financial capacity is also crucial, and governments can support this by subsidising costs related to monitoring and sustainable practices or investing in necessary infrastructure. Some municipalities already apply this and pay the costs for the first year of using tools or negotiate 'bulk discounts' with tool developers. Other means they can leverage are the municipal permit fees organisations are required to pay. Municipalities can, for example, afford discounts to festival organisations that are monitoring their impacts or can demonstrate a certain level of sustainability.

The issue of limited capacities can and should also be addressed by simplifying monitoring processes. Education, knowledge sharing, and practical guidance play a role and can reduce perceived complexity. But, more importantly, tools should allow for differentiation based on the user's experience and proficiency, making the initial steps small and manageable.

For some smaller organisations, however, it can be debated whether the first step should be to monitor at all. These practitioners should be encouraged to first address low-hanging fruit by implementing simple and cost-effective sustainability solutions. Small, but concrete successes like this foster a sense of mastery and purpose. For them, it might be more effective to start with specific assessments of the effects of actual interventions rather than general baseline measurements. This approach aligns better with the practice-oriented mindset of many professionals in the festival sector, who prefer making real-world impacts over number-crunching.

The impact-first approach is more motivating and rewarding than starting with complex data gathering. Festival sustainability advisors shared that when practitioners see the positive impacts of their actions, curiosity about the data behind these impacts naturally follows. Leaving the decision to monitor with the practitioners themselves provides a sense of autonomy, which is an important contributor to intrinsic motivation.

The most significant step in making monitoring more approachable is ensuring a low entry level. This involves keeping financial and time costs low and focusing on key activity categories that contribute most to the festival's total environmental impacts. Initially, festivals should not aim to measure all activities but start with readily available data, such as that from invoices. This small step will not provide a comprehensive insight into the festival's impacts. However, interviewees indicate that such success experiences can motivate, build confidence and even contribute to a sense of purpose when increased sustainability performance is observed.

A next step, as suggested by practitioners, is to make better use of existing systems such as those for ticketing, payment, and logistics and supplier management systems. These systems, if used correctly, can take over much of the work related to data gathering for activities such as attendee travel, food and beverage sales, and supplier transport, respectively. This does, however, require some planning, as the necessary forms and functionalities should be implemented in the system well before the start of the event. The planning requirements of this step make it more complex than just using invoice data, meaning that this could already be considered a second level of monitoring.

One step further would be to actively approach suppliers to request from them the data needed for the monitoring processes. Participants suggested institutionalising such data requests by integrating them into supplier contracts and by standardising data gathering processes. External guidance, such as standardised protocols and example contract formats, would be beneficial. Frontrunners and sector organisations play role in drafting and distributing such resources.

Data availability is critical for effective monitoring. Data partners and suppliers play a significant role in providing the necessary data and should bear responsibility to deliver this data in ready-to-use formats. Tool developers should create functionalities that provide integrations with other platforms and automate certain processes, such as travel distance calculations. Festivals should be able to submit spreadsheets with travel data, that a tool could then automatically convert into the necessary metrics. Such conversion and data preparation functionalities could also be built into the existing ticketing software.

One key insight from respondents is the necessity of a tailored approach in assessing the environmental impacts of festivals. However, this tailored approach conflicts with the goal of obtaining comparable results across different festivals. To reconcile these needs, a standardised, barebones framework that includes only the most essential data points could be developed. This framework would ensure that all festivals report on a core set of activities, enhancing comparability.

Monitoring tools should support this tailored approach by allowing users to answer basic questions about their festival, which would prompt a tailor-made input sheet. For instance, one-day festivals should not be asked to provide campsite or accommodation-related data. Developing these functionalities would require high-level insight into different types and categories of festivals, which do not currently exist.

Future research could identify these essential activities and categorise festival types by analysing a broad range of festivals to determine commonalities. Activities like travel, transport, and energy use, which are common across all festivals, could form the foundation of this barebones model. This standardised model would include the activities that all festivals should measure, allowing for meaningful comparisons and benchmarking.

Customisation could then be allowed in selecting additional activity categories, maintaining some standardisation while accommodating unique aspects of different festivals. This approach addresses the observation by Cavallin Toscani et al. (2022) that most methods in the scientific literature are only applicable to the specific types of events for which they were developed. It also mitigates participants' concerns about the feasibility of a standardised approach in dealing with the heterogeneity of festivals.

Addressing systemic and financial barriers is more challenging, especially for local governments, and even national governments have limited influence on global economic dynamics. However, clear guidance from governments can provide business owners and investors with the confidence to support sustainable practices. This guidance can also strengthen the business case for suppliers, increasing the availability of sustainable solutions by guaranteeing future demand.

The issue of rising prices is more complex, with many interrelated factors. Providing recommendations to overcome these barriers is outside the scope of this study. However, understanding these systemic challenges is crucial for developing comprehensive strategies to support sustainable practices in the festival sector.

5.2 Limitations of the Study

Limitations pertain to both the reliability and validity of the findings, influenced by factors such as sample size, focus on specific types of festivals, reliance on self-reported data, and evolving environmental concerns and regulations. Furthermore, the study's deliberate emphasis on environmental impacts, exclusion of certain stakeholders, and lack of a holistic approach to sustainability highlight the need for cautious interpretation and suggest directions for future research to address these gaps.

5.2.1 Reliability

The reliability of this study is influenced by several factors. Firstly, the sample size of 16 participants, while providing valuable insights, may not capture the full diversity of the festival sector. A larger and more diverse sample could yield more comprehensive results and reveal additional perspectives and challenges. The focus predominantly on established festivals with some level of sustainability practices already in place presents another reliability issue. While these festivals provide valuable insight into the motivations and incentives that have proven effective, the study might not fully represent the challenges and barriers faced by new or smaller festivals just beginning their sustainability journey. Municipalities and general sector organisations included in the study, through their extensive contacts with the entire sector, were able to represent these voices to some extent. However, this might still result in the under- or misrepresentation of the experiences by these parties, as less engaged or informed stakeholders might face different challenges and barriers.

Furthermore, the reliance on self-reported data from festival organisers and sustainability advisors introduces the possibility of biases, such as social desirability bias, where respondents might overstate their commitment to sustainability or underestimate their environmental impacts. This reliance on self-reporting could affect the reliability of the data collected and the conclusions drawn from it.

Environmental concerns and regulatory frameworks are continuously evolving, which may render the study's findings outdated as new environmental issues emerge and regulations change. This necessitates ongoing research to keep pace with these developments, ensuring that the strategies and tools proposed remain relevant and effective.

5.2.2   Validity

The validity of the study is also subject to several limitations. One significant limitation is the deliberate focus on environmental impacts, which does not address social and economic sustainability concerns. Although this focus provides a clear framework for examining environmental impacts, it overlooks the complex and interconnected nature of sustainability. A more holistic approach, considering the interplay between environmental, social, and economic factors, would provide a more comprehensive understanding of festival sustainability.

The exclusion of certain stakeholders, such as provinces and water boards, is another validity concern. Including these stakeholders could have provided valuable insights, particularly regarding water-related issues and broader regulatory frameworks. The study's participant selection, focusing on knowledgeable and sustainability-oriented (often intrinsically motivated) stakeholders, may also limit the validity of the findings. Marginalised groups or minorities are not represented, even though their opinions and concerns might be legitimate and unique. This exclusion could result in a biased understanding of the barriers and motivations for sustainable practices in the festival sector.

Different impacts might be valued and weighted differently by various stakeholders and in different contexts, limiting the certainty and definitiveness with which impact categories can be characterised as essential to include. This highlights the need for future research to explore these differences and develop a more nuanced understanding of sustainability impacts.

The study's focus on music festivals within the Green Deal Circular Festivals (GDCF) context further limits its scope. While this provides a clear context for examining sustainability practices, it may not fully represent the challenges and barriers faced by other types of festivals or events. Testing the findings in other contexts could enhance the external validity of the study.

Lastly, the lack of stakeholder participation in the stakeholder analysis, going against recommendations by Reed et al. (2009), might reflect the biases of the researcher, potentially influencing the findings and conclusions. Engaging stakeholders in the analysis process could provide a more balanced and comprehensive understanding of the issues at hand. This was however omitted due to time restrictions of the project.

These limitations underscore the need for caution when generalising the findings of this study. Future research should aim to address these limitations by expanding the sample size and diversity, considering a broader range of environmental, social, and economic impacts, and continuously updating methodologies to reflect evolving environmental challenges and regulatory contexts. This would enhance both the reliability and validity of the findings, providing a

more comprehensive and accurate understanding of the conditions for continuous improvement of festival sustainability.

5.3 Theoretical Implications

5.3.1 Contributions to the literature

This study makes several significant contributions to the academic literature, particularly in the context of festival sustainability. Firstly, it enhances the understanding of the festival sector, a subsector of the events industry that has previously received limited academic attention. By offering an improved conceptual model specifically applicable to festivals, this research addresses the current absence of agreement in both scientific literature and practical applications regarding the totality of activities related to and occurring because of a festival. The new model consolidates diverging views and partial models from existing studies and integrates real-world insights from festival and sustainability professionals with hands-on experience. This effort contributes to the establishment of consensus and agreement, providing a comprehensive benchmark against which methods and tools can be evaluated. This, in turn, fosters a more substantiated, transparent, and systematic approach to making claims and decisions about what to include in assessments, combating the ambiguity and opaqueness that currently surrounds these decisions.

Furthermore, this study contributes to bridging the gap between high-level theoretical understanding of events in the literature and the real-world experiences of practice-oriented professionals in the festival sector. By incorporating both the insights from standardised scientific assessment methodologies such as LCA and the practicalities and limitations of the sector, the research provides an increased understanding of impact assessment in practice and a way to ensure its continuous improvement. The analysis of methods and tools available to and actually used by festival practitioners, a novel aspect of this study, offers valuable insights into the motivations and incentives for the adaptation of these methods and tools.

Another contribution is the introduction of an impact-first approach. This concept suggests that for some actors, practical interventions should precede comprehensive data gathering, offering a new perspective on engaging festival organisers in sustainability efforts. This approach prioritises implementing low-effort and low-cost solutions that generate immediate results, such as switching to sustainable toiletries and cleaning products, opting for more sustainable catering, increasing the share of plant-based options for example. Interventions like this can subsequently lead to a deeper interest in broader sustainability issues and motivate organisers to start monitoring their impacts. By challenging traditional methodologies that prioritise extensive data collection before intervention, the study proposes a more dynamic and responsive model that aligns with the practical, results-oriented mindset of many festival professionals.

The study also sheds light on systemic barriers and policy implications, providing insights into the complex interplay between regulatory frameworks and sustainability practices. By examining the systemic barriers faced by festival organisers and government bodies, the research underscores the need for clear, supportive policies that enhance the business case for sustainable solutions and provide certainty for stakeholders. These findings contribute to the literature on environmental policy and management, illustrating the importance of government guidance and entrepreneurial advocates (Hekkert et al., 2007), and the potential for mandatory and voluntary pathways to coexist in promoting sustainability.

Finally, another key contribution is made with regards to the development of standardised frameworks. The study provides valuable insights for creating more comprehensive and standardised monitoring frameworks by presenting a more comprehensive model of festival-related activities and at the same time acknowledging the heterogeneity of the sector, addressing the need for applicability across different types of festivals. A first step toward standardisation is provided by defining different levels monitoring with the first levels encompassing activities that are easy to monitor and apply to all festivals, while higher levels require more sophisticated measurement and will see more variability between festivals. By identifying specific measurement challenges, such as attendee travel, rented materials, and attendee-brought items, the research offers a basis for future studies to address these gaps, simplify assessments, unburden practitioners, and enhance the accuracy of environmental assessments.

5.3.2   Suggestions for future studies

Future research could explore the concept of avoided emissions or positive impacts to counterbalance the negative perception associated with measuring environmental impacts, which some stakeholders find overly negative. Quantifying and providing insight into how festivals reduce impacts elsewhere or influence attendees could lend a more positive perspective to the monitoring process. However, this approach would necessitate a solid conceptual and theoretical foundation, as positive impacts are notoriously difficult to quantify and attribute. Future studies could address this.

Conducting full-scale Life Cycle Assessments (LCAs) for various types of festivals is another promising area for future research. This should include contribution analysis to empirically substantiate which activities and impacts are most relevant for festivals and how impacts are correlated. For example, researchers could examine the correlation between water consumption, eutrophication, and ecotoxicity, to establish whether the indicator water consumption could serve as a proxy for the other impacts. The relationship between climate change and other impacts also provides an interesting venue for analysis, particularly as festivals start adopting lower GHG solutions. The findings of the current study, suggesting several

correlations between impact categories could be tested in other contexts to enhance external validity. It is important, however, to realise that using such correlations and proxies can be useful interim solutions before holistic and comprehensive assessments are feasible. Ultimately, though, such approximations can never substitute actual assessments that, hopefully, will become feasible soon.

Furthermore, clear classification of festival types through methods such as cluster analysis could provide deeper insights into how different festival characteristics influence activity data. Big data or trend analysis of multiple festival impact assessments might reveal patterns that inform festival-type-specific benchmarks. These benchmarks could automate the quality checks of data used by festivals and help those with limited data make better assumptions about their potential impacts, thus lowering the barrier to starting sustainability monitoring.

Lastly, regarding the future orientation and motivational aspect of the study, it would be beneficial to conduct longitudinal research comparing the effectiveness of voluntary and mandatory governmental approaches in stimulating the sustainability transition. Investigating the "impact-first" approach, which prioritises practical interventions before comprehensive data gathering, could provide insights into the most rewarding and motivating actions for stakeholders. This approach could help identify low-hanging fruit, making it easier for stakeholders to start measuring and improving their sustainability practices without feeling overwhelmed by the need for comprehensive data collection from the outset. Although many of these preferential actions are already known to experienced practitioners and consultants, academic research could reinforce these insights by validating them through rigorous study. Collaboration between academics and sector practitioners could ensure that research builds on tried-and-tested interventions while the sector benefits from systematic academic approaches capable of detecting higher-level themes and trends. This synergy could enhance both theoretical understanding and practical application, ultimately driving sustainability in the festival sector forward.

5.4   Societal Implications

The findings of this study not only offer value to the academic work on festivals and impact assessment but also have significant societal implications. This section discusses practical recommendations, structured by the stakeholder groups for which they are relevant: festival organisations, governmental organisations and regulators, tool developers, data partners, and suppliers.

Festival organisations are advised to adopt a stepped approach to environmental monitoring, initially focusing on activities with readily available data, integrating systems for comprehensive data gathering, and installing on-site measuring devices. Subsequently, they should engage

stakeholders and suppliers for additional data and conduct on-site research and in-depth data gathering within their own organisation.

Collaboration and training are essential for festival organisations, governmental bodies, sustainability experts, and suppliers, with a particular focus on developing and sharing best practices, and governments providing financial support and infrastructure investment. Additionally, festival organisers and staff should receive training on sustainability practices through educational programmes and workshops organised in collaboration with governmental organisations, knowledge institutes, and sustainability experts.

Governments and frontrunners in the sector should work together to define a long-term vision for sustainable festivals by advocating for ambitious goals and policies, influencing policy development, and setting realistic yet ambitious goals. Organisers and industry bodies should work collectively to ensure that regulatory frameworks are conducive to sustainability, informed by leaders in the sector.

Tool developers should facilitate comprehensive and convenient assessments by implementing a stepped approach, offering customisation options, and providing pre-made templates for input sheets. They should also integrate their tools with other platforms, offer built-in options to request input from suppliers and stakeholders, automate calculations, and provide real-time feedback based on benchmarks. Converting raw impact data into meaningful metrics and visualising these in easy-to-understand graphics is also crucial.

Suppliers and data partners should focus on addressing their customers' growing needs for data by aggregating data from multiple festivals, providing high-level insights, and setting benchmarks. They should build public databases aggregating relevant information and facilitate easier access to activity data, enabling festivals to make better estimates and assumptions for sustainability assessments.

By implementing these recommendations, stakeholders in the festival sector can collectively enhance environmental sustainability and contribute to a more comprehensive understanding of their environmental impacts.

6 Conclusion

This study addresses the effectiveness and future orientation of monitoring tools for the environmental sustainability of festivals, aiming to contribute to a more sustainable festival sector through actionable recommendations.

The research highlights significant gaps in the current tools used to assess the environmental impacts of festivals. These tools often lack comprehensiveness, failing to cover the full spectrum of festival activities and impacts. By expanding the scope of these tools to include a

broader range of activities and implementing robust criteria for scoping and boundary setting, the comprehensiveness of environmental assessments can be improved.

Several barriers to effective and future-oriented monitoring were identified, including financial constraints, limited time and resources, insufficient regulatory support, and challenges in engaging suppliers and partners. Addressing these barriers requires coordinated efforts from festival organisers, tool developers, and legislators to create supportive policies, provide financial incentives, and foster collaborative networks for data sharing and best practices.

From frontrunners in the Dutch festival sector, the study draws valuable lessons. These include the importance of strong leadership, clear sustainability goals, and continuous improvement processes. Successful initiatives are driven by intrinsic motivations, such as a commitment to environmental responsibility, and extrinsic pressures, such as stakeholder demands and regulatory requirements. Integrating sustainability into the core business strategy ensures it is a fundamental aspect of event planning and execution.

Explicitly answering the research questions, the study finds that safeguarding the effectiveness and future orientation of monitoring tools involves ensuring their comprehensiveness and supporting them with a regulatory framework that promotes sustainability. Festival organisers can enhance these tools by embedding sustainability into their strategic planning and leveraging technology for accurate and efficient data collection and reporting. Tool developers should create adaptable and user-friendly platforms to meet the diverse needs of the sector.

By identifying relevant activities and impacts and offering recommendations to overcome barriers, the research contributes to developing a standardised protocol for environmental sustainability assessments for festivals. Furthermore, it provides guidance for festival organisers, tool developers, and legislators on fostering conditions for sustainable conduct, supporting the transition to a more environmentally sustainable festival sector.

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Appendix A – Activity Evaluation Criteria

Table 7. Overview of festival-related activities and the evaluation criteria for assessing current tools

Theme	Activity	Evaluation criteria (Tool requests input of…)
Energy	Electricity from grid	Total on-site electricity consumption from the national grid.
	Temporary electricity generation	Total amount of fuels used in stationary combustion for on-site electricity generation (incl. diesel, biofuel, petrol, and LPG).
	Gas	Total amount of gas consumed for on-site space heating, water heating, or cooking, including gas from national grid and bottled LPG.
	District heating and cooling	Total amount of energy consumed from district heating or cooling networks for on-site heating or cooling.
Travel	Attendee	Total amount of passenger kilometres travelled to and from the festival by attendees, and the modality of travel (incl. foot/bicycle, car, bus/tram/metro, coach, train, boat, plane).
	Participant	Total amount of passenger kilometres travelled to and from the festival by participants* (same method as above).
Transport	On-site and building equipment	All electricity or fuels (incl. diesel, biofuel, petrol, LPG) used for on-site transportation vehicles and building equipment (if there is no option to report this separately, this category is considered excluded)
	Off-site	All energy consumption related to transport of freight to and from the festival site, reported either using total distance, modality, and weight, or by fuel (incl. diesel, biofuel, petrol, LPG) or electricity consumption.
Water	Drinking water	Total amount of drinking water used (incl. consumption, sanitation, food preparation, irrigation, dust control, decorative and recreational uses, maintenance, and cleaning).
	Non-drinking water	Total amount of non-drinking water used (incl. sanitation, irrigation, dust control, decorative and recreational uses, maintenance, and cleaning).
	Wastewater treatment	Total amount of wastewater produced, and treatment method applied (incl. on-site treatment, discharge into sewage system, transportation to external treatment site, or discharge into environment).
Food and beverage	Attendee food	Total amount of food consumed by attendees at the festival, either on individual ingredient-level, or by number of meals and meal type (e.g. white/red meat, veggie, vegan; high, medium, low impact).

	Participant food	Total amount of food consumed by participants* at the festival (same method as above).
	Beverage	Total amount of beverages consumed by attendees and participants at the festival, in beverage type and number of units or volume.
Materials	Procured	Total amount of materials (incl. building materials, merchandise, promotional, other distributed/sold products) procured, measured in weight per material type (incl. wood, metals, textile, plastics, paper).
	Rental	The number of products, items, vehicles, etc. rented for the festival.
	End-of-life	The end-of-life treatment of each of the materials and products (incl. reuse, repair, refurbishing, repurposing, or disposal).
	Waste management	The treatment of all disposed materials and products (incl. composting, recycling, incineration, landfill).
Accommo-dation	Attendee	Total amount of overnight stays of attendees per accommodation type (incl. hotels/hostels/apartments, holiday homes, stays at friend/relatives, campsites).
	Participant	Total amount of overnight stays of participants* (same measurement as above).
Digital	Online activity	All event-related online activity (incl. web hosting and site visits, cloud storage, social media views, app sessions, e-mails sent).
	Digital events	All streaming and online activity related to hosting a digital event (incl. streaming, viewing), with stream duration in [hours] and audio/video quality [GB/hour], and viewing in number of people and viewing duration [person*hours].

*= Participants include all individuals taking an active part in the festival, such as volunteers, crew, artists, and suppliers (ISO, 2012).

Appendix B – Thematic Analysis

This appendix contains tables presenting all high-level themes identified during analysis of the interview transcripts. "*n* of part." refers to the number of participants in the sample that said something which was coded to that theme, "*n* of excerpts" is the amount of interview fragments, or excerpts were coded to that theme.

Table 8. Thematic analysis of the boundary setting criteria for sustainability assessments

Theme	Description	*n* of part.	*n* of excerpts
Assessment goal	The goal with which the assessment is undertaken influences where and how to set the boundaries	**4**	**11**
- Impact allocation	The goal of the assessment is to allocate the event-related impacts to the responsible parties	2	4
- Compliance assessment	The goal of the assessment is to assess whether an organisation or festival is compliant with sustainability related laws and regulations	1	1
- Informing strategy	The goal of the assessment is for the organiser themselves to use sustainability performance data to inform strategic decisions about where to direct efforts and energy	1	1
- Total impact	The goal of the assessment is to craft a complete image of the total environmental impacts that occurred because the festival was organised	2	2
Data availability	Whether data is available to the event organiser influences what and how they can monitor	4	8
Event characteristics	The specific characteristics of a festival influence which activity or impact categories would be relevant	6	22
Influence	The assessment boundary can be informed by considering over which activities the festival organisation can exert any influence	3	7
Responsibility	The assessment boundary can be informed by taking into account the direct (financial/organisational) responsibility of the organiser	4	7
TOTAL		**8**	**55**

Table 9. Thematic analysis of festival-related activity categories

Theme	Description	*n* of part.	*n* of excerpts
Energy	The activity theme energy	7	31
Travel and transport	The activity theme travel and transport	**9**	**26**
- Travel	Activity category travel	8	14
- Transport	Activity category transport	4	8
Water	The activity theme water	**7**	**21**
- Drinking water	Activity category drinking water	2	3
- Non-drinking water	Activity category non-drinking water	1	1
- Wastewater treatment	Activity category wastewater treatment	3	4
Food and beverage	The activity theme food and beverage	**10**	**21**
- Food	Activity category food	9	13
- Beverage	Activity category beverage	2	2
Materials	The activity theme materials	**10**	**45**
- Procured materials	Activity category procured materials	3	4
- Rented materials	Activity category rented materials	3	4
- Waste	Activity category waste	7	16
- Reused materials	Activity category reused materials	2	4
- Items brought by attendees	Activity category items brought by attendees	5	10
Accommodation	The activity theme accommodation	2	6
Digital	The activity theme digital	1	1
TOTAL		**13**	**153**

Table 10. Thematic analysis of environmental impacts

Theme	Description	*n* of part.	*n* of excerpts
Global warming	GHG emissions and climate change	11	18
Water consumption	On-site and up- and downstream water consumption	9	19
Resource scarcity	Fossil and mineral resource scarcity, circular economy	10	22
Local ecosystem biodiversity	Impacts on biodiversity in close vicinity to the festival	**9**	**16**
- NO$_x$ emissions	Nitrogen oxide emissions	5	5
- Protected natural areas	Impacts related to nearby protected areas	1	1
Land use	Up- and downstream land use and land use change	2	9
Human health and upstream biodiversity	Collection of lesser mentioned environmental impacts, see the four below	**5**	**17**
- Acidification	Terrestrial acidification	2	2
- Air pollution	Human toxicity and particulate matter formation	4	6
- Ecotoxicity	Marine, freshwater, and terrestrial ecotoxicity	2	2
- Eutrophication	Marine and freshwater eutrophication	4	7
TOTAL		**12**	**101**

Table 11. Thematic analysis of the technical barriers to monitoring

Theme	Description	*n* of part.	*n* of ex-cerpts
Boundaries	Barriers with regards to setting the assessment boundaries	6	15
Data	Barriers with regards to data gathering	8	22
TOTAL		**11**	**37**

Table 12. Thematic analysis of the organisational barriers to monitoring

Theme	Description	*n* of part.	*n* of ex-cerpts
Motivational	Barriers relating to the organisation's motivation to monitor	8	28
Resources and capacity	Barriers relating to organisational resources and capacity	**10**	**33**
- No capacity	Organisations do not have the capacity	8	13
- Prioritising limited capacity	Other things are prioritised over monitoring	6	6
- Time consuming and costly	Monitoring consumes too much time and is expensive	5	9
- High regulatory burden	Organisations already experience a high regulatory burden	3	5
TOTAL		**11**	**62**

Table 13. Thematic analysis of the barriers to sustainable behaviour

Theme	Description	*n* of part.	*n* of excerpts
Motivation	Organisations are not motivated to act sustainable	6	16
Limited capacity	Organisations have limited capacity for sustainability and experience a high regulatory burden	3	3
Financial barriers	There are financial reasons for not being sustainable	**7**	**18**
- Financial hardship	Organisations struggle financially	5	11
- Holding companies and investors	Organisations are often owned and governed by holding companies and institutional investors who are difficult to influence	3	7
External factors	External factors influence organisational sustainability	**10**	**30**
- Systemic factors	The current economic system poses inherent barriers	8	14
- Availability	Limited availability of sustainable solutions	6	12
- Dependence	Organisations are dependent on external actors for change	4	4
TOTAL		**13**	**68**

Table 14. Thematic analysis of the risks and barriers of imposing regulation

Theme	Description	*n* of part.	*n* of excerpts
Legal barriers	There are legal barriers limiting what is possible in terms of permit requirements and subsidy conditions	3	5
Limited enforcement capacity	Municipalities have limited capacity to enforce sustainability regulations	1	2
Resistance	Organisations might resist top-down obligations	7	13
Effectiveness	Imposing regulation might be counter-productive	4	8
TOTAL		**9**	**31**

Table 15. Thematic analysis of the risks of voluntary approach to sustainability policy

Theme	Description	*n* of part.	*n* of excerpts
Progress rate	Change happens slower when it is not obligated	3	3
Discontinuation	There is a risk that initiatives are discontinued when financial support stops	2	5
TOTAL		4	10

Table 16. Thematic analysis of motivations and incentives to monitor

Theme	Description	n of part.	n of excerpts
Why organisations monitor	Motivations within the organisation for monitoring	**10**	**26**
- Intrinsic motivation	There is intrinsic motivation within the organisation	2	4
- Internal use	Results are used for internal communication	5	9
- External communication	Results are used in external communication to stakeholders	3	5
- Compliance	Results are used for compliance reasons	5	8
Increasing or adding incentives	Increasing motivation through added incentives	**12**	**35**
- Internal	Organisations can increase incentives within the organisation	1	2
- External	External incentives can increase motivation	7	20
- Technical	Technical functionalities can increase motivation	8	13
TOTAL			

Table 17. Thematic analysis of ways to lower the barriers to monitoring

Theme	Description	n of part.	n of excerpts
Clear guidelines	Clear goals, targets, and rules by the government	3	6
Capacity building	Increasing capacity to monitor within organisations	**7**	**31**
- Financial resources	Provide financial resources to support monitoring	5	5
- Human resources	Train and educate employees	6	20
- Partnerships and collaborations	Bringing together parties, talking to and learning from eachother	2	40
Low entry level	Low complexity for organisations who are just starting	*9*	22
Tailored approach	Approaches that fit the need of organisations	8	27
Tool characteristics	Functionality in tools that makes them easier to use	4	8
TOTAL		**13**	**139**

Table 18. Thematic analysis of motivations for sustainable behaviour

Theme	Description	*n* of part.	*n* of excerpts
External incentives	External pressure and motivations for sustainability	12	42
Facilitation	Taking organisations by the hand and help where needed	11	62
Self-interest	Factors that benefit the organisation	7	28
Stimulating experiences	Motivating positive experiences and feelings	9	23
Organisational culture	Measures organisations can take to create an organisational culture fostering sustainability	7	60
Systemic	Changes to the economic system that can promote sustainability	3	4
TOTAL		**14**	**229**

Appendix C – Current Tool Detailed Activity Analysis

	Climeet	CO2-Calculator | Events	Creative Climate Tools (CC Tools)	Environment-i-meter	Event Carbon Calculator	Event Carbon Footprint Calculator	GDCF Monitor (v2024)	Green Events Tool (GET)	Green Gen Calculator	Green Producers Tool	Milieubarometer	myclimate Event Calculator	Planet Positive Event	The Denver Eco Friendly Event CO2e Emissions Calculation Tool	TRACE	ZERO
Energy - Electricity - Grid	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Energy - Electricity - Temporary	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No
Energy - Other energy - Gas	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Partially	Partially	Yes	Yes	Yes
Energy - Other energy - District H&C	Yes	Yes	Yes	No	No	No	No	Yes	No	No	Yes	No	Yes	No	No	No
Transport - On-site - On-site (& building)	Yes	No	No	No	No	No	Yes	No	No	Yes	No	No	No	No	No	No
Transport - Off-site - Fuel use	Yes	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No
Transport - Off-site - Distance & modality	Yes	No	No	Yes	No	No	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No
Water - On-site - Drinking water	Yes	No	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes
Water - On-site - Non-drinking water	No	No	No	Yes	No	No	Yes	No	No	No	No	No	No	No	No	No
Water - Wastewater treatment	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
Materials - Procured	Yes	Partially	No	Partially	Yes	No	Yes	Yes	Yes	Yes	Partially	Partially	Yes	No	Yes	No
Materials - Renting	Yes	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	Yes	No
Materials - End-of-life	Yes	No	No	No	No	No	Partially	No	Yes	No	No	No	Partially	Yes	No	No
Materials - Waste management	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Partially	Yes	Yes	Yes	Yes
Travel - Attendee	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Partially	Yes	Yes	Yes	Yes	Yes
Travel - Production (crew, artist, suppliers)	Yes	No	No	Yes	No	No	Yes	No	Yes	Yes	Yes	Partially	Yes	Yes	Yes	Yes
Acommodation	Yes	Partially	No	Yes	Yes	No	Yes	Partially	Partially	Yes	No	Partially	Partially	No	Partially	No
F&B - Food - Attendee	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes
F&B - Food - Crew, artist, suppliers	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	Yes	Yes
F&B - Beverage	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No
Digital - Online activity	Yes	No	No	No	No	No	Yes	No	Yes	No	No	No	Partially	No	No	No
Digital - Digital events	Yes	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	Yes	No