From Carbon Footprint to Social Justice: Rethinking Sustainability in Television Production and Virtual Studios

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ABSTRACT

The environmental and social impacts of television drama productions are staggering, with a single hour-long episode generating an average carbon footprint of 77 metric tonnes, equivalent to driving a car around the world six times. Key contributors include extensive fuel consumption (58% of emissions), air travel, energy use, and accommodation. This research explores the integration of environmental and social sustainability practices across diverse filming contexts, addressing the absence of clear, adaptable guidelines for production teams.

There is clear evidence for pushing the integration of sustainability practices in the entertainment industry. However, the lack of research in this field is a challenge. What is the climate impact of the various production operations? What are the greener choices? And what about diversity, health and safety, and workers' unions? When every production is unique, how does one know the best option for sustainability?

This research aims to advance environmental and social sustainability integration across various departments and production locations. This research project addresses the lack of concise and clear sustainability guidelines tailored to each filming department and adaptable to multinational productions. A multinational project team of academics and practitioners from five countries simulated the monetary and environmental costs of filming a six-episode television period drama set in both Denmark and Argentina. The simulations assessed the effectiveness of the proposed environmental and social sustainability guidelines across the different production methodologies.

Some early adopters and industry experts suggest that virtual production could enhance crew diversity and mitigate biodiversity loss within the entertainment sector. This belief has driven significant investment in costly virtual production studios across Europe. However, these claims remain largely theoretical, lacking robust empirical validation. To bridge this gap, this project undertakes the world's first large-scale investigation to quantify and qualify the environmental and social impacts of virtual production, providing data-driven insights into its true potential for sustainable filmmaking.

DISCLAIMER: At the time of writing this text, final results have not yet been obtained from the research.

CCS CONCEPTS

• Applied computing→ Arts and humanities→ Media Arts; • Computer systems organization → Real-time operating systems; • Human-centered computing→ Interactive systems and tools; • Computing methodologies → Computer graphics → Animation.

KEYWORDS

Sustainability, Virtual production, Environmental and Social sustainability, Television

1 Climate impact from television production

Studies reveal that producing a typical drama production has the same carbon footprint as driving a car around the world six times [1], highlighting the significant impact of small-screen productions on society and the environment. A recent report noted that a single episode of an hour-long drama production results in a carbon footprint of 77 metric tonnes; with filming taking place in multiple locations, 58% of emissions came from fuel usage [2]. Air travel in a single production equates to 75 return flights from America to Europe, and its energy consumption could power Times Square for 5 days [3]. The primary contributors to the carbon footprint in television production include utilities, fuel, air travel, and accommodation. The CO2 emissions from crew hotels alone equal those of 34 households over a year (ibid). The average screened content typically has a carbon footprint of 16.6 tCO2e/hr (a UK resident's emissions over 18 months). On the other hand, drama productions have almost triple the footprint [1]. Over half (51%) of these emissions are from travel and transport alone, with air travel as the dominant contributor (ibid). Drama productions typically have a larger carbon footprint due to longer shoots, increased on-location filming, additional travel requirements, bigger budgets, and larger crews. Productions with higher budgets and well-known talent will likely buy new materials and use business-class flights, furthering their carbon impact.

2 Social dilemmas

Only 1 out of every ten crew members describe the entertainment industry as a mentally healthy workplace. Moreover, a significant portion of British film crew members—over a third—reported working more than 50 hours per week, and a quarter of respondents

acknowledged experiencing thoughts of suicide [4]. Similarly, the #metoo movement originated from the entertainment sector and has since spread throughout society, prompting conversations and changing social norms. Actors often discuss the work of intimacy coordinators as part of press tours today. The role of nudity riders has been normalised, and more actors request green riders detailing green set procedures.

Social sustainability issues in the film and television industry present a complex social dilemma. On one hand, the industry plays a vital role in entertainment, education, and cultural expression, bringing joy and meaning to millions worldwide. The industry also employs hundreds of thousands of workers, providing economic opportunities and livelihoods [7]. However, the industry also bears witness to severe safety issues, mental health challenges, and inequitable power dynamics.

3 Research methodology

This research employs a **comparative case study methodology** combined with **simulation modelling** to evaluate the environmental and social impacts of different production concepts. The case study for this project is based on a fictional web series. The simulation involves applying environmental and social guidelines to different production concepts.

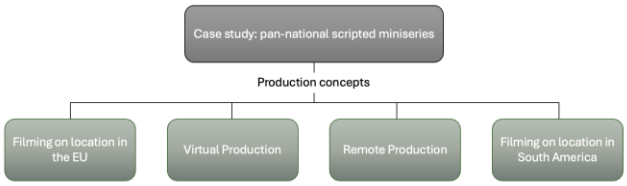

Figure 1: Case Study

Figure 1 illustrates the case study framework, detailing the production processes and how sustainability practices are integrated at various stages. These guidelines serve as a practical tool for industry professionals, aiming to bridge the gap between theoretical sustainability goals and actionable production strategies. Combining case study methodology with a simulation model provides a holistic approach to studying the application of the social and environmental sustainability guidelines to the production concepts.

Each production concept works with environmental and social sustainability practices to provide different solutions to doing a holistically sustainable production. The sustainability practices are gathered in guidelines with the purpose of supporting production decisions that will result in more environmentally and socially sustainable approaches.

3.1 Environmental guidelines

The environmental sustainability guidelines provide a tiered framework of green practices, developed through a comprehensive review of existing practices and industry standards. These guidelines are organised and tailored to address the specific needs of each production department, ensuring that sustainability is integrated across all facets of production. One key objective is to broaden the responsibility for sustainability beyond a single "green manager" by involving all relevant departments in the decision-making process.

For each production department, the guidelines present a series of options, ranked according to environmental sustainability. Option 1 represents the most sustainable choice, followed by Option 2, and subsequent options with progressively lower levels of environmental impact. This tiered approach allows for flexibility, enabling production teams to select sustainability practices based on their available budget and capabilities. In addition to department-specific guidelines, a separate set of general environmentally friendly practices is compiled, applicable to all individuals involved in the production process. This ensures that sustainability becomes an integral part of the entire production team's responsibilities, promoting a shared commitment to environmental stewardship.

The guidelines are designed to accommodate a wide range of production scales and resources, making them adaptable for use in both large-budget and smaller-scale projects. This flexible framework aims to facilitate the adoption of sustainable practices in diverse production environments, aligning with both environmental goals and practical constraints. The guidelines reflect recommendations for filmmaking based on existing advancements in technology. Therefore, the guidelines serve as a work-in-progress open to further development and addition of new knowledge.

3.2 Social guidelines

The social sustainability guidelines provide a range of approaches addressing multiple social dimensions, such as labour rights, mental health, diversity, and community engagement. These guidelines are informed by research into existing social sustainability practices across various industries, as well as by internal knowledge and expertise within the entertainment sector. Each approach is assigned a weighted score based on its value, the required efforts for implementation, and the associated budgetary considerations. This scoring system allows production teams to evaluate and select the most appropriate social sustainability practices according to their specific capabilities, resources, and objectives. The guidelines aim to foster a more equitable and inclusive production environment while balancing practical constraints.

4. Magnifying the virtual production concept

In the ever-evolving landscape of filmmaking and content creation, the emergence of virtual production has sparked a compelling discourse around its potential as a more sustainable alternative to traditional production methods.

Virtual production, a blend of live-action cinematography and computer-generated imagery, has gained significant traction in recent years. The virtual production concept is believed to entail various benefits for both the environmental and social aspects of film and television production.

In an environmental context, virtual production has the potential to significantly reduce transportation and travel-related emissions, as well as mitigate biodiversity destruction. By shifting filming and set construction from outdoor locations to controlled indoor studios, virtual production reduces the need for extensive travel to remote or environmentally sensitive areas, thereby minimising the production's ecological footprint. Additionally, this approach reduces the environmental impact associated with on-location set building and the disruption of natural habitats.

From a social sustainability perspective, the ability to control lighting and environmental conditions within a virtual studio offers several benefits. By eliminating the dependency on natural light and weather conditions, virtual production reduces the need for night shoots. It minimises the likelihood of prolonged working hours or last-minute schedule changes. This control over production conditions can lead to more predictable work hours, improving crew well-being and mitigating the risks associated with overwork, fatigue, and disrupted schedules. These factors contribute to a more stable and healthier working environment for the production team.

This research project will investigate whether virtual production truly offers sustainable benefits, both environmentally and socially. It will assess the environmental impact of virtual production by analysing its potential to reduce travel-related emissions, minimise resource use, and protect biodiversity. These aspects will be compared with areas of environmental impact within virtual production techniques, such as power consumption. In terms of social sustainability, the study will examine how virtual production can improve working conditions by offering greater control over schedules and work hours, potentially reducing the need for night shoots and overtime. Through a comprehensive analysis, the project aims to provide empirical evidence on whether virtual production can deliver on its sustainability claims across both environmental and social dimensions.

5. Constraints from technological development

Television production is an industry that is intrinsically linked to broader patterns of technological advancement. The creative sector is continually seeking to enhance production methods and adopt state-of-the-art technology for content creation. However, this constant cycle of innovation raises significant concerns regarding the generation of electronic waste and the broader sustainability of production practices. When exploring technology updates, it is highly relevant to consider the environmental sustainability impact of the frequent replacement of technological equipment and materials.

Despite increasing awareness, current studies and industry guidelines addressing the environmental impact of virtual production technologies remain incomplete and lack comprehensive scientific validation, such as life cycle assessments for individual components. This gap in empirical data complicates the evaluation of whether replacing older, functional equipment with newer, more energy-efficient alternatives result in a net environmental benefit. While this study and guidelines do not have scientific support from a lifecycle assessment on the individual options for up-and-coming technology within television production, however, the guidelines mentioned are a work-in-progress with the scope for further additions in the future. Future research is needed to rigorously assess these trade-offs and to support the development of sustainable technology transition strategies. While the acceleration of technological development undoubtedly opens new creative possibilities, it must also be critically examined through the lens of environmental responsibility.

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