Sustainability in film set design – a preliminary assessment

Shreya Mahajan[1] and Sonia Suri[2]

[a]M.Sc.(Interior and Furniture Design) School of Architecture and Design, Lovely Professional University, Phagwara, India.[1]

[b]Assistant Professor (Interior and Furniture Design) School of Architecture and Design, Lovely Professional University, Phagwara, India.[2]

Shreyamahajan.2018010130.bcom@gmail.com[1] Sonia.suri@lpu.co.in[2]

DOI:10.48047/ecb/2023.12.si4.766

Abstract:

The film industry has been growing tremendously since the invention of motion pictures. However, the production of film sets has been leading to a significant carbon footprint, making the industry one of the biggest contributors to greenhouse gas emissions. According to reports, the film industry is one of the those who leave the biggest carbon footprints. The amount of CO2 that a movie can produce with a budget of more than $70 million is equivalent to 11 trips to the moon and back. Sustainable methods could reduce waste produced, and fossil fuels burned from transportation used in filmmaking. The movie industry is suspected of booming in India, which will unavoidably lead to more waste generation. However, many government/ non-government organizations are working to reduce the carbon footprint generated by effective waste management systems. However, in the long run, new composite materials that are sustainable in nature should be used instead of traditional set design materials to achieve a high degree of sustainability and minimize carbon footprint. This issue has been explored in this paper by researching the trend of "green filmmaking" and the use of sustainable methods, waste management, and new composite materials to reduce the environmental impact of filmmaking.

Keywords: carbon footprint; composite materials; waste management; sustainable materials; new techniques of production and construction

1. INTRODUCTION

Set design entails creating a physical location based on the background of a story, which plays a vital role in generating the mood or atmosphere for the storytelling style. It could be a cityscape, a landscape, or something out of a fantasy, a fusion of architecture, interior design, and the arts. (Rethinking The Future, n.d.)

Film is a potent instrument for conveying messages and is frequently utilised as a tool to connect people in making a difference for society. We may have seen several films that deal with environmental issues. However,It is difficult to manage elastic supply of assets to minimise the ecological impact of film production. CO2 emissions are increased by the vehicles and tools used to make any film, including automobiles, trucks, limos, generators, air trips, trailers, and various machinery(Meilani 2020). The film industry is, however, one of the businesses with a significant carbon footprint and

high energy use. It is one of the sectors of the global economy that uses the most energy and has the most significant carbon footprint. The average big-budget film production generates 2,840 tonnes of CO2, according to the report Screen New Deal. This amount would require 3,709 acres of forest per year to absorb. A movie with a budget of above $70 million can emit 2,840 tonnes of CO2, which is the same as travelling from the moon to the earth 11 times.(Calawerts 2022)

2. LITERATURE REVIEW:

This article discusses the current trends and methods used by the film industry to reduce its carbon footprint, as well as the sustainable composite materials that can be used for better outcomes. It has been discovered that Filmmakers can develop a green movie by focusing on the five areas that have been identified as the most effective at reducing emissions, using secondary data from relevant sources, peer-reviewed academic articles and online sources. And comprehend why Meilani's [2021] environmental measures are crucial and advantageous for society and business. The Pyramidal Lattice Sandwich Structure (PLSS) is capable of building light-weight load-bearing structures for a variety of vehicles, from ground to aerospace. It has a high stiffness and strength-to-weight ratio. Although these constructions have a higher strength to weight ratio, their ability to absorb sound is being studied. Jie Liu [2018]. S Ramakrishnan, K Krishnamurthy, R Rajasekar, and G Rajeshkumar carried out an experimental investigation on the impact of nano-clay addition on the mechanical and water absorption behaviour of jute fiber-reinforced epoxy composites. [2018] Ramakrishnan1 et al. A variety of eco-friendly materials that act like plastics but are created from mushrooms are developed by Ecovative Design. Younsung, Kim and Daniel Ruedydiscovered that the mushroom container is recyclable and biodegradable and can be created from crop waste from nearby farms. Kim et. al.[2019]

3. DIFFERENT SUSTAINABLE STRATEGIES

3.1 Sustainable strategies adapted by the organisations and the industry

There are many organizations that have realized this serious issue and have taken steps toward the betterment of society. The insightful measures have been taken to recognizable change to the current scenario and reduced the carbon footprint generation. Following are a few organizations that are working hard to bring a change to the current scenario:

3.1.1 CERE (Mumbai, India)

Mumbai-based CERE specializes in environmental sustainability and is working towards making the film industry more sustainable.

Every stage of the film's pre-production and production was examined by CERE (the steps of preparation prior to a film shoot). The carbon footprint of the movie was assessed by taking into account catering, set building, hotel stays, air and ground transportation of personnel and equipment, as well as other factors. For each activity, CERE computed the carbon dioxide emission of 78.47 metric ton scientifically established emission factors (MtCO2e).

The goal was to eliminate from the equivalent amount of carbon dioxide from the atmosphere as was produced while making the movie. CERE suggested planting 560 indigenous trees of various species to mitigate the emissions. In some areas of Bombay and Assam, where the movie was filmed, the deed was finished for a small portion of the movie's budget. As a result,In 2015, "Aisa Yeh Jahaan" became India's first carbon-neutral feature film. (Chandramouli, n.d.)

3.1.2 Green Film Shooting:

Green Film Shooting offers perspectives on sustainable operating procedures in Europe and other parts of the world. From theatrical and/or television releases of feature films, TV programmes, and ads, to theatres that use less energy and clever IT management, not to mention recyclable DVD covers created without toxic solvents at the consumer level. Cine Tirol Film Commission, n.d. [2023]

In addition, Green Film Shooting offers a forum for ambitious and innovative media professionals to share information, concepts, and novel viewpoints. With their award-winning tv and cinema documentaries since 1989, they have proven that creativity and sustainability are not mutually exclusive in the filmmaking industry. They have now made over 80 films that are as climate and environmental friendly as possible.

3.1.3 Earth Angel

Similarly, Earth Angel is an organization whose mission is to transform industries by applying innovative and workable new solutions on manufacturing sites. After the shooting is finished, most of those working on production sets are aware of their environmental impact. Sound stages, production vendors, film offices, and productions can benefit from Earth Angel's services. The services are based on theclient's requirements and concentrate on four major areas: strategy, staff, goods, and data. Since 2013, Earth Angel has contributed 129,201 pounds of supplies, reduced industry emissions by 21.1%, and helped clients save over $1.2 million. It has helped the industry by lowering production's carbon footprint by 16,016 metric tons. And divertedmore than 19,000,000 pounds of production waste were diverted from landfills, and 3,897,850 single-use plastic water bottles were avoided.

Through education, waste reduction, resource management, and carbon tracking,sustainable consulting services has lower the carbon footprint of entertainment projects. They supply the labour and resources needed to assist film, television, and commercial productions achieve carbon-neutral targets across all departments. Their motive is to educate viewers about responsible and sustainable productions. They believe that an industry with such a large impact on society should model progressive practices to promote sustainability on and off the screen.

3.1.4 Skarp (Mumbai, India)

Sustainable solutions for set design [2016] Over 17,000 kg of waste was recovered from the Hindi film Chandigarh Kare Aashiqui sets. Instead of going to the landfill, it was composted, recycled, and donated. This accounts for more than 95 percent of the waste generated throughout the shoot that does not end up in landfills. Co-producer Pragya Kapoor spearheaded the initiative to make this big film a zero-waste set in conjunction with Skarp, an environmental sustainability consultancy that works on creating zero-

waste solutions for businesses. Skarp attempted to limit the use of single-use plastics by using water dispensers and compostable plates.

4. METHOD OF MANAGING GENERATED WASTE METHODS.

The generated waste is managed through the following ways:

i. Reusable water bottles and water dispensers have taken the role of plastic bottles.
ii. Sustainable solutions for set design [2016] Low-income families received the leftover food from the sets. To reduce food waste, they collaborated closely with the film's production and catering departments to double-check food orders. Excess food was collected and distributed to residents with the assistance of groups such as Feeding India and Robinhood Army.
iii. To separate the garbage, a specialised team was employed.At the shooting locations, a waste separation system was established, a uniques team was created tosegregate waste, the waste was segregated into more than 15 types before being transferred to recycling and composting facilities.

Figure 1. segregation of waste in process(Sharma 2021)

iv. Large bottles rather than little ones of toiletries were distributed to the crew members.
v. Solid, liquid, and PPE categories were separated on the sets using color-coordinated bins.

Figure 2. colour-coordinated bins(Sharma 2021)

vi. Waste that was gathered during shoot was converted into bricks, lights, and

other useful items.

"Sustainable solutions for set design" [2016] Following the adoption of waste

Figure. 3: recycling PPE kits into bricks (Sharma 2021)

management, the amount of waste disposed of in landfills decreased almost 87% from approximately 325 kg per day to an average of less than 4 kg per day.
The use of green film shooting procedures has benefited the film business in several ways. Here are some of the changes it has brought about:

- ***Lower environmental impact*:** The film industry has lowered its environmental impact by employing sustainable practices in film production. As a result, the amount of garbage produced has decreased, as have greenhouse gas emissions.
- ***Reduced production costs*:** Sustainable practices are frequently associated with lower production costs. Filmmakers are saving money by decreasing garbage and the waste generated by following the waste management practices.
- ***Increased public awareness*:** As the public becomes more environmentally sensitive, adopting green film shooting procedures can assist in raising awareness of environmental issues. Films that advocate sustainable activities can inspire viewers to embrace environmentally friendly actions in their own lives.
- ***Better reputation:*** Film productions are boosting their reputation as socially responsible organizations by implementing sustainable techniques. This can attract viewers and investors who want to support ecologically accountable efforts. For example the Hindi movie called " Chandigarh Kare Aashiqui" got popularity for being the first zero waste film.Ramakrishnan,et al[2020]

4.1 Insight into the composite materials available:

Although the organizations mentioned above attempt to transform the business through waste management and disposal strategies, none focus on employing more sustainable and environmentally friendly materials in the manufacturing process. To make the production process more sustainable, we should move away from the traditional materials that are now employed and instead work with different composite materials that are more environmentally friendly, making the production process of this industry more sustainable.
Following reports discuss about various composite materials and structural technique

Concerns about the environment and society are motivating scientists, researchers, and material engineers to investigate, design, and suggest more advanced materials for use in the automotive, aircraft, building, marine, and packaging industries. These materials have better load-bearing and environmental characteristics. The advantages of lignocellulose fiber-reinforced polymer composites are biodegradability, availability, simplicity of manufacture, low cost, notable qualities, and light weight. Ramakrishnan1 et.al. [2018] S Ramakrishnan, K Krishnamurthy, R Rajasekar, and G Rajeshkumar carried out an experimental investigation on the impact of nano-clay addition on the mechanical and water absorption behaviour of jute fiber-reinforced epoxy composites.

Compression moulding was used to successfully construct the composites, and study was done on the tensile, flexural, impact, and water absorption characteristics. The influence of fibre length, fibre weight fraction, NaOH treatment concentration, and weight percentage of nano-clay addition on the above qualities was investigated, and the aforesaid findings were recieved.

Though composites have some advantages and disadvantages, combining two different materials' functional properties, reduced manufacturing costs and faster processing time, and so on make them versatile materials in engineering and technology. As a result of this conclusion, the technology certainly reveals that the most popular material in the present trend is composite.

According to the experimental results,one of ideal reinforcements for building epoxy-based polymer matrix composites are Cloisite 20A nano-clay and NaOH-treated jute fibre. These composites could be an excellent material to utilise at the production site because they can be used in a number of medium and light load applications in both industrial and home settings..Ramakrishnan1 et al. [2018]

Pyramidal lattice sandwich structure (PLSS) can produce light-weight load-bearing designs for ground to aeronautical vehicles due to its high stiffness and strength-to-weight ratio. While these constructions have a higher strength-to-weight percentage, Trusses have not long ago become one more type of periodic lattice structure, consisting of two thin but strong face sheets separated by cores with an open cell topology. Liu, Chen, and Zhang [2018]

PLSS properties like out-of-plane compression and shear, vibration, and shock loading have all been thoroughly investigated, but their capacity to insulate against sound has received far less attention.

Styrofoam boxes and hazardous plastic can be replaced with sustainable materials already used by other sectors. The innovative American business Ecovative specializes in modifying organic processes to produce sustainable materials. This East Coast manufacturing company has created Myco Foam and Myco Board, two sustainable mushroom materials that may be applied to building construction, furniture design, and packaging.

Mycelium is a fascinating substance because it self-assembles; it can transform waste materials, such seed husks or woody biomass, into chitinous polymers that can be shaped into almost any form. As in the plastics industry, items can be moulded using mycelium as an adhesive.Kim and Ruedy [2019]

Mycelium is the material that insulate and are vapour, moisture, fire, and temperature resistanthas been given a Class-A fire rating by ASTM E84, the standard test procedure for the surface burning properties of construction materials because it naturally resists fire. This is a huge benefit for set designers as it eliminates the need to utilise any hazardous resources, chemicals or materials that contain such compounds.

4.2 Parameters contributing to the demand for innovative composite materials in theindustry:

i. Aesthetics: Films frequently demand visually unique and one-of-a-kind sets and props. Composites may be moulded into various shapes and sizes, enabling filmmakers to establish detailed plus complicated designs that with conventional materials would be challenging or impossible to accomplish.
ii. Durability: Composites are more durable than traditional materials, making them excellent for sets and props that must be used repeatedly, transported, and stored.
iii. Light-weight: Weighing less than traditional materials, composites are easier to handle, transport, and install on set. This is especially true for large-scale sets and props that must be transported regularly.
iv. Cost: Composites can be less expensive than traditional materials, mainly when designing intricate designs. They also require less maintenance, saving money on labour and materials in the long run.
v. Considerations for the environment: Because composites can be created from recycled resources, they are more environmentally friendly than traditional materials. They can also be made recyclable or biodegradable, decreasing their environmental impact.

5. GAP/ PROBLEM IDENTIFIED

i. materials used in the production of a set is another factor/ contributor to the generation of the carbon footprint which the organisations or the industry is not working on.
ii. Composite materials that are sustainable and are available are not being used in the process of production of sets, using such materials can further lower the carbon footprint generated by the film industry.

6. CONCLUSION

Film industry is one of the most diverse industries due to its varied production scale. There is a need to work on composites and their structural application so that new and better materials can be used in the industry. They should work on building and testing more and more prototypes of such composite materials to ensure that these new materials can provide the diversity required in the industry.The need for more visually appealing, durable, light-weight, cost-effective, and ecologically friendly materials drives the demand for innovative composite materials in set production in the film industry. As technology advances, new composite materials are expected to be produced, enhancing filmmakers' capacity to build unique and intriguing sets and props.

Overall, green film production has resulted in beneficial developments in the film industry by promoting environmental sustainability and minimizing the industry's ecological effects. These practices along with a better choice of material for the production process, it would further reduce the environmental (carbon) footprint. The industry must thrust to explore for better and newer materials, and structure techniques that are light-weight and sustainable and incorporate these into the set design production process so that the film industry can take a step towards being a sustainable industry would help the film industry to be more sustainable and environmentally conscious industry.This could open up new opportunities for organizations already working in the field of producing green or zero-waste film. This also helps in fulfilling the sustainable development goals in the industry.This enhances the area of scope for the composite materials and a different and an advanced sector of film industry to work on in future.

Disclosure Statement:
The author states that there are no potential conflicts of interest.
Funding detail:
No monetary benefit of any sort was taken for the research

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