Eco backstage and its sustainability in terms of design, material or technology

Gabriela Albu[1, 2*]

[1]Doctoral School of Architecture, Center of Architectural and Urban Studies, Ion Mincu University of Architecture and Urbanism, 18-20 Academiei Street, 010014, Bucharest, Romania
[2]"I. L. Caragiale" National Theatre Bucharest, Boulevard Nicolae Bălcescu No. 2, 010051, Bucharest, Romania

Abstract. On the website of the European Parliament, it is stated that "the global economy uses the equivalent of one and a half of the planet's resources in order to produce global results and to absorb waste, and estimates show that these numbers will rise to the level of the resources of two planets by 2030." Although ecological, sustainability and resilience policies have been adopted through legislation over 60 years ago, humanity finds itself at a point in time when the linear economy and demographic growth are still the main causes for the imminent depletion of natural resources, thus endangering the environment, the planet and the human species itself. In parallel with the implementation of these laws and policies, humanity is also aiming to conquer new territories or to exploit other planets. Although this is a more modern and glamorized mind-set, one that encompasses the whole solar system, it is, in essence, still a primitive "colonizer" thinking pattern. Under these circumstances, sustainable design has become not just a necessity, but rather a sine qua non for survival. Changing the traditional model of the economy to a circular one means multiplying the life cycles of a product. Thus, this paper aims to examine the "greening" of theatre set production by implementing circular design as the primary method to reshape material resources, technology, and product design processes, serving as the sole approach to prevent waste production.

1 International Green Theatre

As early as 1960, the consumerist side of Western society began to emerge, along with its negative implications [1]. Landfills overflowing with single-use packaging have drawn the attention of the cultural community, which began to take a stand. Besides the artistic aspects, culture has a social component: it reflects the state of society and is opinion-forming. As a result, it has the capacity and moral obligation to educate the public and correct attitudes towards the environment and ecology through the power of example.

Among the seven arts, film and theater are the most significant sources of pollution. Set manufacturers follow the traditional economic paradigm, based on the consumerist principle of resource exploitation: acquisition, production, and disposal ("take, make, and

* Corresponding author: albu.gabi@gmail.com

waste/dispose"). The disadvantages of this model have quickly become visible, having been the source of multiple severe ecological issues for several decades now.

One of the pillars in the area of art sustainability is the Center for Sustainable Design (CfSD), a British organization established in 1995 within the University of Creative Arts (UCA), whose activity is dedicated to product sustainability research and training via conferences, workshops, and training courses focused on sustainable innovation and product sustainability.

On the other side of the planet, Japan is one of the countries that not only promotes but also applies the principles of ecological, circular design. The Kyoto Protocol, drafted in 1997 and ratified in 2004 by 40 countries, including Romania, targeted the reduction of pollutant emissions by 8% over a period of 4 years as a follow-up to the warnings issued by the scientific community on the impending global warming caused by carbon emissions generated by human industrial activity.

For the last 20 years, Japan has become a role model for implementing the circular economy paradigm and eco-technology. One notable endeavour in this respect is EcoDesign'99, which is a series of international symposiums organized annually in Japan since 1999 on the theme of circular design. Thus, as a continuation of its forward-thinking tradition, Japan hosts the International Symposium on Eco-Conscious Design and Reverse Manufacturing (EcoDesign2023) in Nara.

On the backdrop of such resolute environmental-focused efforts, theatre companies began to follow suit, reconsidering the way they operate. The international meetings and conferences organized on the principles of sustainable development led to the drafting of plans and agendas undertaken at global and local levels, which were quickly adopted by international cultural entities.

In 2015, a group of environmental artists initiated the *Ecostage Pledge*, a motivational commitment that had the mission to link, via a global platform, professionals in the performing arts sector interested in implementing ecological practices, while offering them the opportunity to exchange experiences.

The forced respite imposed by the pandemic, when the public activity of the theatres went on standby, proved to be beneficial for reconceptualization. Humanity was given the opportunity to reinvent, reorganize, and improve itself. It was given the chance to be reborn from its own ashes.

Thus, environmental concerns and the carbon footprint reduction efforts brought together freelancers and venues, companies, and producers in organizations such as Creating Carbon Scotland, Julie's Bicycle, the Sustainability in Production Alliance (SiPA), Ecostage, Albert and Broadway Green Alliance, etc., that started in May 2021 to develop a guide in three online volumes, "*Theatre Green Book*", on making theatres sustainable. The first published volume of this guide focuses strictly on show production, "*Sustainable Productions,"* [2] the other two volumes dedicated to the sustainable design and operation of theatres, „*Sustainable Buildings*"[3] and "*Sustainable Operations*" [4]. Alongside the guide, they also launched an online platform accessible to all theatre makers interested in streamlining their practices and activities to make them more environmentally friendly. In addition to the assistance provided to interested parties, the platform centralizes data on the sustainable practices of affiliated theatres and serves as an open communication interface for the international theatre community.

2 Reality check

The foreign-born eco-friendly model is currently contemplated by some of the Eastern European theater communities, but it is hardly implemented. The reasons are easily identifiable in the absence of environmentally safe training for the professionally active

generations, for whom designing, producing, and operating in a resilient and sustainable manner equates to an extra financial and time-consuming effort. Thus, the introduction of new concepts and working methods is difficult considering the pressure faced by performing arts workers: excessively frequent premieres, short production times, and tight budgets.

For example, the repertory theatre system, in the Romanian cultural context, requires performances to be produced in succession, to run alternately (sometimes with even half a year between performances), and then to be scrapped, but with difficulty (due to bureaucratic and complex accounting operations). While the schedule of a state theatre (funded by local administrations) has to include a minimum of between 2 and 7 premieres per year, national theatres may easily exceed these numbers. For reference, in the first half of this year (2023) alone, the National Theatre in Bucharest produced 11 shows, while its current repertoire includes around 90 shows. As a result, a concrete and immediate issue faced by most repertory theatres is the lack of storage space. Once the causes of this issue are identified, potential directions for study and a number of applicable solutions may be outlined.

If one considers how set designs are thought out, along with a series of other aspects related to the infrastructure and logistics of theatres, it becomes readily apparent that there are areas for improvement. In other words, adopting an environmentally conscious behaviour that involves the recycling and reusing of certain elements could be a critical part of the solution: saving the planet by saving space. If the ecological and civic spirit of decision-makers cannot be activated and mobilized, maybe pointing out the immediate, tangible benefits could draw their attention.

To illustrate this, let's consider the following example:

The storage space allocated to the scenery of a large-scale show can easily exceed 100 sq m. Consequently, several questions arise:

- Under these conditions, how many thousands of square meters are necessary for a theatre warehouse that hosts dozens of sets simultaneously?
- Are the set components designed in a flexible and modular manner? Is it possible to reuse them for other shows or events?
- What pecuniary benefits would be obtained, and how much time and space would be saved if more interest was shown for investing in a more responsible, committed, in-depth, detailed training and planning process?

Taking a closer, more thorough look at the key words "flexibility," "modularity," "reuse," "planning," or "committed," a new series of questions arises, with much broader implications that are not limited only to the usual concerns of the theatrical sector:

- What percentage of the materials used for the set building can be reused or recycled?
- How much waste results from the production and scrapping processes, and what percentage of such waste is not biodegradable?
- Is the impact of the products resulting from set scrapping on the environment understood? Is the so-called carbon footprint acknowledged?

A deeper and more detailed analysis reveals a series of issues related to the rethinking [5], reusing, remodelling, and recycling [6] of sets or to the streamlining of storage methods. These are relevant topics, but they are rarely discussed in theatrical analyses or specialized literature. It is possible that addressing these issues will provide a remedy, albeit a partial one, thus helping theatres to draft and implement efficient production, operation, and storage methods.

In order to solve, at least in part, the above-mentioned issues, a change in the approach at the national level is necessary. The theme of sustainability in the theatrical sector in

Romania is still not one visibly undertaken by key stakeholders, while beyond Romania's borders, it has already become the norm.

3 Sustainable Approaches in Theatre Arts

At its core, ecological activism in the theatrical sector is guided by a series of principles derived from the initiatives developed ever since the 1970s, when the "3R: REDUCE, REUSE, RECYCLE" waste management campaign was launched. Over time, four other rules were added, representing the new paradigm for scenographers: RETHINK, REDUCE, REFUSE, ROT (or similar words that start with R but have the same meaning).

While some principles focus strictly on material typology and processing technologies, others target the conceptual field - the creative process. It is crucial for theatre creatives to take environmental accountability, requiring them to think and act responsibly towards the environment. They must become aware of their educational mission of informing and shaping society. The design process represents the starting point, the key moment on how to approach any given project.

The scale of scenography projects varies depending on the size of theatre companies. Obviously, the most sustainable theatres are the small, low-budget, independent venues. To survive artistically, it is imperative for such small companies to save materials and resources. Creative freedom is therefore conditioned by the available play and storage spaces, budget, personnel, and deadlines.

Thus, RETHINK, REDUCE and REFUSE are the three concepts without which independent companies could not exist. These provide an example of good practice for all theatres. It is to be noted that there is an unintended congruence of pauperism with environmental activism.

In Romania, it is extremely rare to have a creative team aiming to develop an eco-friendly production from the very beginning. There are a few ecologist initiatives here and there, but relative to the mainstream national context, they become insignificant. Most commonly, the issues lie in the conceptual and technical approach of scenography projects by theatre creatives. Their interest in the overall mood and visual effects' aesthetics is only natural. However, it is insufficient to have scenography projects limited only to mood boards and, at best, to technical solutions. Theatre creatives should choose the technology, the modularity, and the materials based on the above-mentioned key sustainability factors. Abstracting and minimizing sets can be an option, but they should not become the norm (Fig. 1).

Sceneries can be made sustainable if they are designed in this way from the very beginning. This requires the entire creative and technical staff to adopt an eco-friendly behaviour while complying with the new rules of the game [7,8].

Fig. 1. Rethink, refuse, reduce scenography production methods: "Stop the Tempo" - The Romanian Drama Writers Theatre, Bucharest, Romania, 2023.

It is a known fact that some directors request scenery elements and props during the working process, only to discard them later. Such elements, once purchased or crafted but refused, become a wasted surplus. Basically, they are scrapped before being used, resulting in a waste of materials, resources, space, and money. Rethinking, reducing, and refusing are paradigms that must be undertaken not only by the creative team but by the whole theatre staff. It is an arduous process and difficult to enforce, for it requires a positive mind-set and openness from all people involved. It is thus imperative for managers or decision-makers to have a broader view and allocate additional time to the concept phase so that the artistic and technical teams may successfully join efforts. The main goal here is to rethink or even discard some of the customary technologies or materials and to identify or envision new sustainable alternative solutions. However, an original and resilient vision requires expertise, experience, imagination, and communication.

In my PhD research, I noticed that the small community theatres abroad, which carry out activities targeting the local communities, store their current repertoire sets in the warehouses of local theatre schools, thus providing them with learning materials. Once the projects end, the sets may be kept by the schools. Moreover, the materials recovered from the sets' disposal can become a valuable resource for future productions by either the same theatre company or other cultural entities.

Lending, even for a short period of time, any scenography components of sets designed for the shows in the current repertoire of any theatre is risky. Items can be damaged or lost; either way, it is uncertain whether they will ever be returned. Thus, the idea of permanently collecting from theatres only the components coming from former performances no longer in the repertoire is a valid and sustainable one. In this case, the risk is zero, such scenography components being already, at least in theory, amortized assets, having only an intrinsic value.

But what actually happens to the scenography items of past shows that are no longer part of the repertoire? They may be kept in the theatre's warehouse collecting dust, or, at best, they may become scenery elements in new performances. Of course, there is also the possibility that the set designer may be allowed to purchase their own "work of art," but in most cases, the "work of art" is scrapped or ends up in a landfill. In theory, only the elements whose repair becomes too expensive are permanently decommissioned. But even if refurbished, items from past shows will probably never be used again, thus pointlessly

taking up storage space. Most theatres cannot afford to house such items with little potential for use.

One possibility for such scrapped items is to be upcycled. In an ideal world, a dedicated place would be established where theatres could dispose of the items they no longer use and which may be used in the educational process or in the current activity of other theatres, i.e., a shared warehouse where discarded sets, props, and costumes could be stored. Such a warehouse would be able to receive donations from those wishing to scrap reusable items. Moreover, such a warehouse could collect and capitalize on the stored items. Such approaches exist as private businesses: flea markets and outlets that, without having a cultural target, are mainly used by artists.

The film industry, for example, has such well-organized halls for props. It is necessary to establish such storage centres for theatres as well, following the model of those abroad.

The managers of such centres should be neutral entities, such as theatre universities, which could, through grants, build or rent buildings for storage and production purposes equipped with the classic workshops for carpentry, locksmithing, upholstery, painting, prop making, tailoring, shoemaking, and dyeing processes. The craftsmen could thus work on refurbishing and maintaining the scenery elements collected from donations, disposals, or scrapping processes and, in addition, work on new productions using upcycled or recycled items. Furthermore, students could benefit from having access to an abundance of learning materials and to a dedicated space where they could learn, practice, and experiment with making set design elements, or even learn to manage the workshops or participate in the sorting and identification of stored items.

These common resources, once established, could be accessed primarily by the entities that contributed to their set-up. Furthermore, such centres may generate income in at least two ways: by renting out the stored items to other legal or natural entities or by making or repairing scenery, props or costumes for other theatres, on the condition that the students' practice sessions and exams take priority.

The demand for quick accessibility could be fulfilled by digitizing inventories, which would be the first condition for having an optimal flow. Thus, the relevant images for each product could be uploaded on the warehouses' websites, identifying the objects by category. The browsing experience could be further enhanced via the implementation of filters: by time period, style, dimensions, materials, colours, etc. Moreover, the websites could include historical data for each individual item (i.e., the show(s) in which an item was used, along with all the related details – who were the artistic and technical teams - as well as links to theatre archives, photos, posters, etc.). These details will also give those items sentimental value while giving them an identity. On-site identification would also be extremely easy thanks to the digital inventory platforms, which could indicate the exact availability and location of the items in the warehouse.

The development of mobile applications would also allow remote browsing. The logistical aspects of warehouses could be covered by specialized companies that provide consulting services. Outsourcing such tasks to professional planning companies saves time and money in the long run and maximizes operational efficiency.

All of the above can actually be developed and implemented given that, in recent years, the European Commission has approved national recovery and resilience plans, as well as the set-up of levers through which grants and loans from the EU can be accessed for waste management.

Moreover, given the context above, items that cannot be reused or repurposed (upcycled) could be recycled.

In the field analyzed in this paper, recycling means choosing and using materials in a manner that allows the dismantling of the scenery and set design elements at the end of their operating lives, and the reintroduction of the recovered materials into a new

production cycle as secondary materials. Thus, wood, metal, aluminium, paper, textile products, and even plastic or polystyrene can be collected, sorted, and recovered by specialized recycling companies. Steel and aluminium, for example, can be recycled up to 100%, while glass can be remelted indefinitely. Moreover, recycling costs are lower than production costs.

In the UK, the company Green Clover has been focusing for over 30 years on the recovery, recycling, rental, and production of sceneries. The London National Theater and the Young Vic use recycled sets that they buy or rent from various companies.

However, production workshop managers avoid recycling sets, as the process can be laborious and may prove inefficient in the context of tight execution deadlines. A set built from scratch can be finalized much faster, which is a critical factor given that the time allocated for set-making is usually limited to about two months. In contrast, in the independent sector, any material that can be reused or recycled is greatly appreciated.

This brings this paper to the next topic of discussion: "ROT." "ROT" does not refer to consumable props but to the preferential use of biodegradable materials in the shortest time possible and to the highest possible percentage. The environmental impact of our waste is directly proportional to the time it takes for it to naturally degrade.

Organic materials are the only ones that are 100% biodegradable. The breakdown interval varies according to the materials' composition: paper or cardboard decomposes within a year, while polypropylene takes 150 to 500 years to decompose but does not completely disintegrate. Aluminium decomposes largely within 200 -500 years, while glass can actually last between 4.000 and 1 million years. It is to be noted that the materials with the highest recycling potential "rot" the slowest.

To illustrate this, we can take a look at the Japanese architect Shigeru Ban, laureate of the Pritzker Prize for the application of innovative technologies and materials and creator of exterior and interior spaces from recycled and biodegradable cardboard elements - "paper tube structures".

Following his example, the set and props of the show "Our Daily Hunger," from the repertoire of the Replika Educational Theatre Center, an independent theatre in Bucharest, were made 90% from paper and cardboard, the rest of the elements being reusable or biodegradable (Fig. 2).

Fig. 2. "Our Daily Hunger," an immersive performance at Replika Educational Theater Center, Bucharest, 2015.

The differences in resources between state and independent theatres boil down to three key factors: space, budget, and human resources. In their absence, the only option is to create and construct in a responsible and intelligent manner. Since the artists in the independent theatre sector constantly face challenges and constraints, they seem to come up with the best sustainable and resilient solutions to be able to financially support their productions. Without pretending to have ecological concerns, their scenography apply sustainable eco-scenography principles.

The COVID-19 pandemic determined an unprecedented decrease in the financial resources of state theatres, which made theatres resort to a frequent practice in Romania: the reuse of discarded sets, a true model of sustainable practice that, however, does not stem from any ecological motivation but is due to an economic crisis.

As an example, we have the scenography for the show "Helver's Night" (Fig. 3), which was crafted during this period and focused on upcycling for economic reasons, from the management's point of view, and for ecological reasons, from the artistic team's perspective. The show managed to achieve both economic and ecological objectives. Thus, the auditorium was reconfigured, and the stage area was constructed exclusively from repaired, rearticulated, or reassembled pieces of furniture and objects recovered from the theatre's warehouses or even brought from home, the outcome being a functionally and aesthetically harmonized "Frankestein" type of set.

Fig. 3. "Helver's Night," National Theatre, Bucharest, 2021. Furnished exclusively from repaired, rearticulated, or reassembled pieces of furniture and objects.

Although it seems insignificant, the scenographers' effort to search, procure, repair, adapt, and harmonize the components of such a set can be akin to that of designing the space ab initio, if not more demanding and more thorough. The status of employed stage designers seems to be burdened by this aspect, as they predominantly have in their portfolio a series of such shows. The positive aspect lies here in their know-how to turn scraps into opportunities.

Such a project can be frustrating for an artist who has to express their spatial vision by resorting to a collage-type composition of objects designed by other scenographers.

Another problem, this time moral, not legal, is that of copyright, which, although transferred to the theatre, still bears the imprint of the designer.

In addition to the monetary benefits resulting from the optimization of production time, the recovery and reuse of discarded objects from non-theatrical settings such as homes, schools, hospitals, institutions, or any other abandoned or decommissioned constructions bring to the visual dimension not only an added aesthetic value but also a sentimental one.

Furthermore, their technology, material, trim, style, and details could not be replicated in the production workshops to the same quality level as the originals, no matter how skilled the craftsmen are; time constraints just do not allow it.

In the case of the show "Bibi," from the Gong Theatre for Children and Youth in Sibiu, Romania, the team had the opportunity to access and reuse scrapped or abandoned objects from a few educational institutions. The pieces of furniture and props were all authentic and were recovered from an abandoned provincial school and from the attic of a high school in Sibiu. Having been used by generations of children and teachers, all these objects had their own energy, being loaded with history and meanings (Fig. 4).

Fig. 4. "Bibi"- Gong Theatre, Sibiu, 2021. The furniture pieces and props are recovered and authentic.

Since its establishment in 2015, the team of artists from the Replika Educational Theatre Center in Bucharest, consisting of three actors, a director, a playwright, an architect, and a video artist, has structured its performance design activity around the circular paradigm. As a result, the sets of shows in the centre's repertoire were conceived as ecologically as possible from recovered materials, designed to be recyclable, or made from modular, interchangeable structures.

Modular structures are user-friendly, low-weight, and allow for quick installation while making storage and transport more efficient. Currently, the Layher-type structures allow existing portable systems used for events and concerts to be adapted for the stage and technical circumstances of theatres. These are portable structural assemblies made of aluminium and steel that guarantee viability and durability and have optimized manoeuvrability and functionality without overlooking resistance, stability, and security in operation. Such structures are suitable both for temporary architectural constructions (they

can be operated for years) and scaffolding, as well as spectator stands or stages for specific events (concerts, festivals, outdoor performances).

The adoption and adaptation of such a system on the stage of the National Theatre in Bucharest is illustrated below (Fig. 5). The figure presents the assembly steps of a LED scenery: the basic structural elements, the first assembled modules, the cladding, and the final result.

If this type of structure, together with other modular elements, were used for more theatrical productions, the crafting and assembly time issues, as well as those of accessibility and transportation would be solved, while the carbon footprint would be significantly reduced.

Fig. 5. The Layher-type structures used for the "GOPO Awards Gala," Bucharest National Theatre, 2023.

4 Conclusion

The sustainable mind-set, along with the ecological approach of projects by theatre creatives, needs to be shaped and stimulated at the school level.

A first step could come from the academic environment, where scenography are made for a relatively small number of performances per year or for undergraduate exams. Ideally, such sets would be 100% recyclable.

It is difficult and yet necessary that, even under time constraints, we also consider the issues of eco-design, eco-materials, and eco-technologies. There is still no established tradition of ecological education, while the legislation is still permissive and the civic spirit leaves much to be desired.

People aged 50 and older are familiar with sustainable practices, having lived under the communist regime. The target segment, however, consists of individuals under 50 who were born and raised in a capitalist mind-set and linear political context. For them, resilience and sustainability are not regarded are not seen, at least for the moment, as genuine guidelines but rather as trendy lifestyle concepts. The only chance is for the very younger generations to be educated in a non-invasive, non-consumerist, circular spirit.

As a result, at the governmental level, the Ministry of Education and the Ministry of Environment, Water, and Forests support the educational units and institutions involved in the organization and implementation of the national program "Green Week," which aims to contribute to the "development of the competences of pre-schoolers, pre-primary children, and pupils to inter- and transdisciplinarily explore their surrounding reality and to the development and fostering of responsible behaviours towards the environment." The program includes educational activities that support the protection of the environment and the prevention of climate change.

Thus, there is hope; it is yet to be seen whether it is not too late to act.

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