

SUSTAINABLE HOTEL DESIGN STRATEGIES: TOURISM AS A TOOL FOR CIRCULAR BIOECONOMY IN FRAGILE ECOSYSTEMS

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ABSTRACT

This paper focuses on the exploration of sustainable design strategies of hotels and resorts located on fragile ecosystems with the aim of reversing climate change and addressing the encroachments on nature and mishandling of waste that together lead to increased risk of repeated pandemics, thus making our planet more resilient to both. The tourism industry is responsible for 5% of greenhouse gas (CO₂) emissions and is expected to increase by 130% by 2050. The World Tourism Organization and the United Nations Development Programme are committed to inspiring and facilitating collaboration with stakeholders to advance the contribution of tourism to the sustainable development goals. To this end, the paper explores the sustainable design strategies of the 6-star sustainable hotel and resort, Caves & Waves, as a case study. The resort is fully integrated into the natural landscape, it takes advantage of the orientation and sea view with integrity throughout all the common and private spaces, 10% of the total capacity facilitates disabled access, it favours natural cooling and airing of the spaces, it is constructed from natural and recyclable construction materials (local stone, wood), it uses renewable energy sources (solar rooves), it reinforces local vegetation, it handles water recirculation, waste processing, and garbage recycling correctly, and as a result, it is integrated into the international network of sustainable constructions by minimizing its ecological footprint, while simultaneously increasing its positive effect on the environment. Through the analysis of the above-mentioned case study, the paper highlights the key sustainable tourism design strategies regarding the 3-zero triple bottom line concept committed to zero kilometres, zero carbon dioxide and zero waste with the aim of handling the tensions between sustainable hotel design in fragile ecosystems and commitments to business development and continuing economic growth.

Keywords: sustainable tourism, sustainable development, climate change, circular economy, ecological, hotel design strategies, fragile ecosystems.

1 INTRODUCTION

In the last 50 years, the biosphere, upon which humanity depends, has been altered to an unparalleled degree. The current economic model relying on fossil resources and addicted to “growth at all costs” is putting at risk not only life on our planet, but also the world’s economy. The need to react to the unprecedented COVID-19 crisis is a unique opportunity to transition towards a sustainable wellbeing economy centred around people and nature. After all, deforestation, biodiversity loss and landscape fragmentation have been identified as key processes enabling direct transmission of infectious diseases. Likewise, a changing climate has profound implications for human health. Putting forward a new economic model requires transformative policies, purposeful innovation, access to finance, risk-taking capacity as well as new and sustainable business models and markets [1].

2 CIRCULAR BIOECONOMY IN FRAGILE ECOSYSTEMS

A circular bioeconomy offers a conceptual framework for using renewable natural capital to holistically transform and manage our land, food, health, and industrial systems with the goal of achieving sustainable wellbeing in harmony with nature. There is a need to mainstream



bioeconomy within the rest of the economy, not just advance it as a separate sector of interest to mainly rural communities. In particular, it is crucial to connect bioeconomy to the circular economy concept. Together they are stronger and make more sense in terms of reaching societal goals, than advancing them separately [2].

Contemporary tourism proves that experiencing different places is one of the main human interests, although this value today tends to be lost. In fact, modern man for a long time believed that science and technology had freed him from his direct dependence on places. Even in 1969, Lawrence Durell wrote: “As you slowly begin to learn about Europe, tasting its wines, cheeses and the characters of different countries, you begin to realize that the defining element of any culture is the spirit of place” [3]. Two-thirds of travellers will pay more money for products and services to companies that are committed to positive social and environmental impacts [4]. Tourist accommodation should reduce CO₂ emissions by 66% per room (2030) and 90% per room (2050) according to the Paris Agreement on Climate Change (2016). The U.N. World Tourism Organization predicts that by the year 2020, there will be some 1.6 billion eco-inspired trips taken. Eco-friendliness is evolving from a nice-to-have, on-trend hotel commodity to a must-have priority for a growing number of environmentally and socially conscious travellers [5].

The World Tourism Organization and the United Nations Development Programme “are committed to inspire leadership and facilitate collaboration to inspire stakeholders to advance the contribution of tourism to the SDGs”. The year 2016 was a turning point: the 2030 Agenda for Sustainable Development and its sustainable development goals (SDGs) were adopted, and the Paris Agreement on climate change came into effect [6], [7]. These sent out a global political message on the way forward to transform our economic system to end poverty, protect the planet, and ensure prosperity for all. In this direction, while tourism is providing a significant boost to many local and national economies, mass tourism has been shown to pose a significant environmental defragmentation of the natural landscapes and fragile ecosystems. The hospitality industry uses substantial amount of energy and material resources while the embodied carbon produced in the whole supply chains seems crucial [8]. The effects on the natural environment include emissions to and pollutions off water resources, soil and the air, noise as well as the excessive use of locally available resources.

3 CASE STUDY: CAVES & WAVES

Caves & Waves is a sustainable hotel design manifesto that seeks to re-establish the “unconsciously repulsed” [9], [10] uprooting of man from nature: a statement that is vital to the current social and cultural reality of contemporary civilization, although it is a concept originally been implemented during the Romantic Revolution of the 19th century [11]. The architectural proposal, deeply rooted in the “Genius Loci” and the “phenomenology of architecture” [12], places the modern cosmopolitan “traveller – flaneur” [13] in the fundamental existential “in-between” space of the natural and the manmade place (topos). Thus, the proposal re-interprets the natural phenomena and the elements of the environment as a tool for the re-composition of the ground – terrain in “existential” terms in order to provide the infrastructure for man to “dwell” between the earth and the sky [14]–[16].

3.1 Interpreting the fragile ecosystem

The main concept of the architectural composition resulted from the lived experience of the place. A landscape characterised by sparse, mostly low, and bushy vegetation. Few trees – mostly cedars – are visible in the region. A harsh, dry, rocky, Mediterranean landscape with earthy colourations. A sloping landscape, eroded at its lowest point by constant direct contact with the sea.



3.1.1 Caves & Waves

Following an in-situ observation of the natural formations and cavities of the rocky terrain (CAVES) as formed by lengthy contact with the ocean vortices (WAVES), the central idea of the new hotel complex was composed, separated into two basic units. Firstly, the unit of habitation, as an archetypal “cave-womb” [17]–[19] – an intrauterine subterranean spatial quality – within the ground, and secondly, the horizontal surfaces of the “tamed” water that follows the ground elevation curves, as natural elements for the production of kinetic energy, capable of shaping both the dwelling-space, as well as the bioclimatic functionality of the hotel complex (Fig. 1).



Figure 1: Bird's eye view – Building and landscape integration. (Source: Alexandros Kitriniaris, KAAF (Kitriniaris Associates Architecture Firm), www.kaaf.gr. All rights reserved.)

3.1.2 Inhabiting the womb

The first sense of unfamiliarity that modern man experiences when he comes to contact with nature occurs due to its “uprooting”, its removal from it. Nature, which was completely familiar to primitive man, was alienated with the process of repulsion in the context of civilization and in-depth progress time and turned into something strangely unfamiliar (uncanny) to man. Therefore, modern man when it comes in contact with nature it experiences the unfamiliar as historically repulsed [20]. The concept of caved or dugout architecture first appears in nature from the beginnings of primitive habitation.

3.1.3 Return to nature

The lust of the endometrial existence, he mentions Freud, appears because the womb is the first abode that man experiences, without even being able to perceive it. His mother's womb

is man's first refuge, in which he remains for nine months, and therefore the most intimate place he will ever experience. It is there that he feels for the first time the concept of protection and security. The connection to the womb refers to the need for man to return to where he came from, to the earth first and then symbolically inside the womb.

3.2 Sustainable design strategies

Waveforms express a characteristic structural determinism with their forms, depending on the reaction of the water to the forces acting through it. A vortex embodies the totality of dynamics in a balanced axis, which, after lengthy contact with the ground, shapes hollows that can potentially contain a residential space, as a "Vessel of Life" [21] capable of enveloping every primary human creative activity in a meaningful way. The archetypal space-womb creates a protected, subterranean hollow within which every human primary and creative activity develops both directly and meaningfully. The multiplication of the spatial womb comprises a structural complex that determines the primary residential space that is disengaged from personal peculiarities as it becomes incorporated into the natural landscape (see Fig. 2).

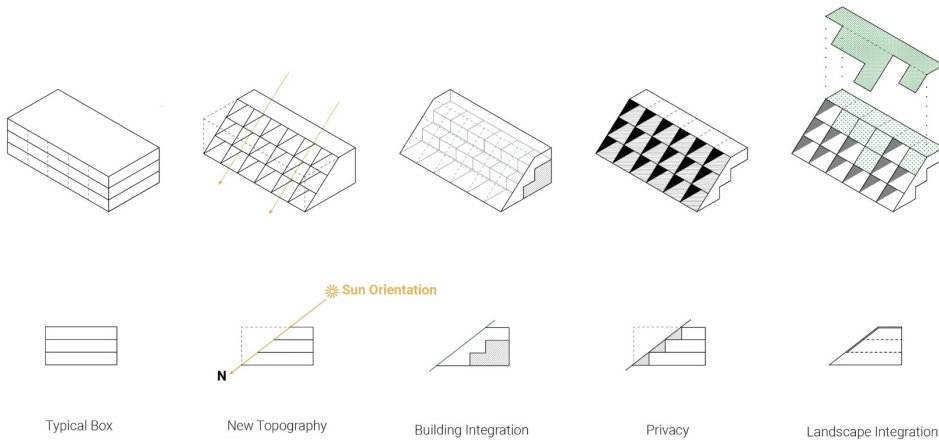


Figure 2: Main concept diagram. (Source: Alexandros Kitriniaris, KAAF (Kitriniaris Associates Architecture Firm), www.kaaf.gr. All rights reserved.)

3.2.1 Compositional principles

The building design comprises 2,500 m² of common public areas, 7,000 m² of private space (rooms), and 3,000 m² of auxiliary space. The compositional structure of the hotel comprises five clearly delineated zones (see Fig. 3). The circulatory and functional connection between the zones is achieved firstly through a smooth central network of internal circulation that follows the vertical curves and includes the movement of electric vehicles and pedestrians; and secondly, through a vertical subterranean system of wagonettes at the eastern border of the plot. The existing street planning system of the private settlement to the west forms the point of reference for carving each parallel zone into the landscape, while the basic levels of the complex's carved streets are articulated in parallel to the vertical curves of the terrain (see Fig. 4).

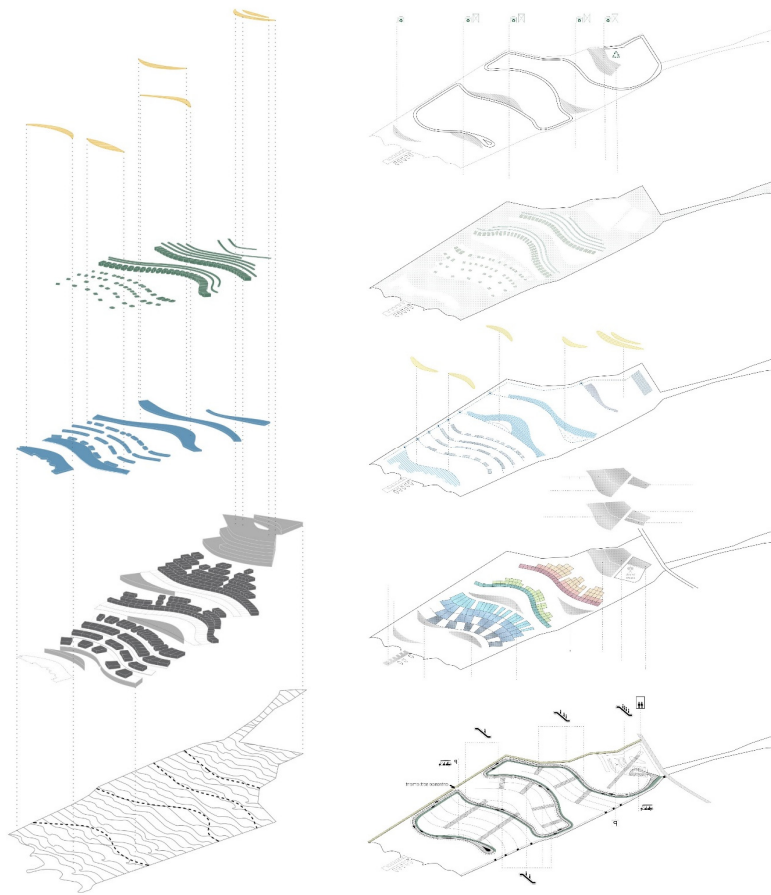


Figure 3: Compositional exploded analysis diagrams. (Source: Alexandros Kitriniaris, KAAF (Kitriniaris Associates Architecture Firm), www.kaaf.gr. All rights reserved.)

3.2.2 Bioclimatic principles

The hotel complex integrates advanced energy and water utilization processes regarding its bioclimatic operation. The solar leaves which are placed in the oases of the swimming pools function on the one hand as a shelter and on the other hand collect and store the solar energy. Water reservoirs collect rainwater from the specially designed surfaces and roofs while reusing it either for internal use or for irrigation. The vegetation is mostly low similar to the surroundings while placing bigger trees on the rooms' landscaped areas to enhance the microclimate and protect the courtyards from the north winds. Finally, advanced actions have been taken to energy management of the hotel complex with the aim to cover operating costs over the project's lifetime and generate an acceptable rate of return (see Fig. 5).

3.2.3 Accessibility

The hotel complex is designed to be accessible for people with special needs. The accessibility of the caved buildings is done from corridors at the back side, in order to permit

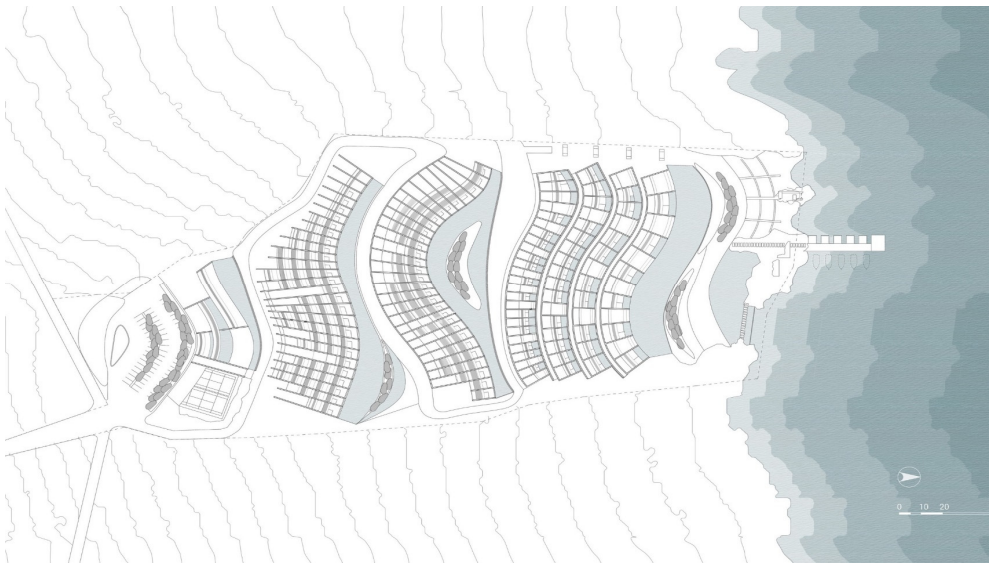


Figure 4: Masterplan. (Source: Alexandros Kitriniaris, KAAF (Kitriniaris Associates Architecture Firm), www.kaaf.gr. All rights reserved.)

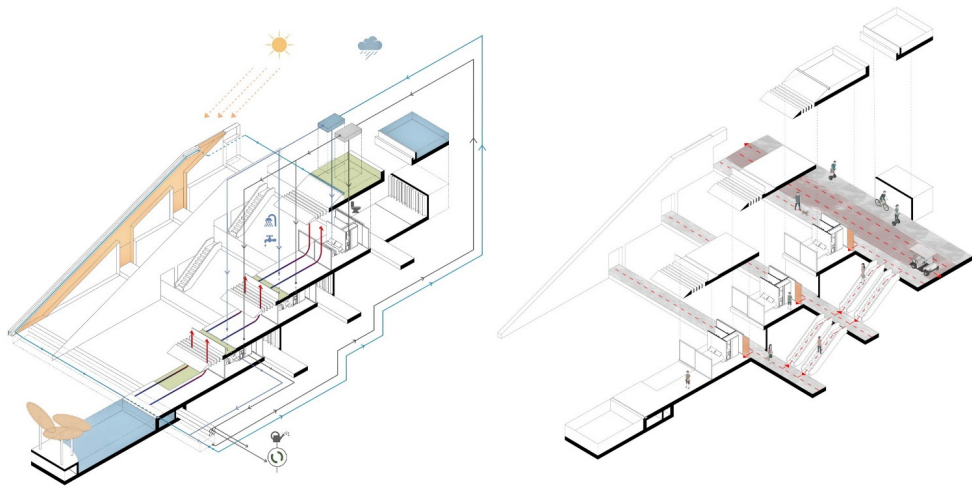


Figure 5: Bioclimatic and accessibility diagrams. (Source: Alexandros Kitriniaris, KAAF (Kitriniaris Associates Architecture Firm), www.kaaf.gr. All rights reserved.)

natural lighting, cooling and ventilation for most of their length. In this way, the unobstructed view of all the rooms to the sea is always maintained without being interrupted. The rooms are accessed via escalators to ensure the two-way direction. Access to the rooms and common areas is ensured in every part of the complex while 20% of the rooms have direct access level from the internal road network.

3.2.4 Building and landscape integration

The phenomenon of repetition is understood as a process of the human brain, according to which the perception of an object is compared to other objects that are in close proximity to it. In this sense the synapses of the human brain compare only the neighbouring object to construct its structure while relating it to similar images. In this direction, the avoidance of the phenomenon of repeatability of the architectural design, is done through the gradual composition of the building units in the landscape in order to create irregular cavities for the penetration of the natural element (planting and water). In this way the perception of the building structure is perceived as fragments as it diffuses with the natural landscape (see Figs 6–10).



Figure 6: Exterior view of the dug-out units. (Source: Alexandros Kitriniaris, KAAF (Kitriniaris Associates Architecture Firm), www.kaaf.gr. All rights reserved.)

3.2.5 Material resources

The construction of the load-bearing structure of the caved buildings is made of reinforced concrete which is produced by cement companies that perfectly manage the CO₂ emissions and take care of the social responsibility of production of aggregates from reuse of raw materials. Reinforced concrete is also used for the construction of swimming pools and water tanks. Natural stone from the excavations is used as a cladding for the walls of reinforced concrete. Finally, natural wood is used as a material for ceilings, interior walls and floors, with the aim of reducing the ecological footprint. To this end, the project is constructed from natural and recyclable construction materials (local stone, wood), while contribute to global and local supply chains by minimizing embodied carbon of materials and promoting reusability and traceability [22] (see Fig. 11).



Figure 7: Exterior views of the waterfront and pool bar. (Source: Alexandros Kitriniaris, KAAF (Kitriniaris Associates Architecture Firm), www.kaaf.gr. All rights reserved.)



Figure 8: Interior view of the communal areas. (Source: Alexandros Kitriniaris, KAAF (Kitriniaris Associates Architecture Firm), www.kaaf.gr. All rights reserved.)

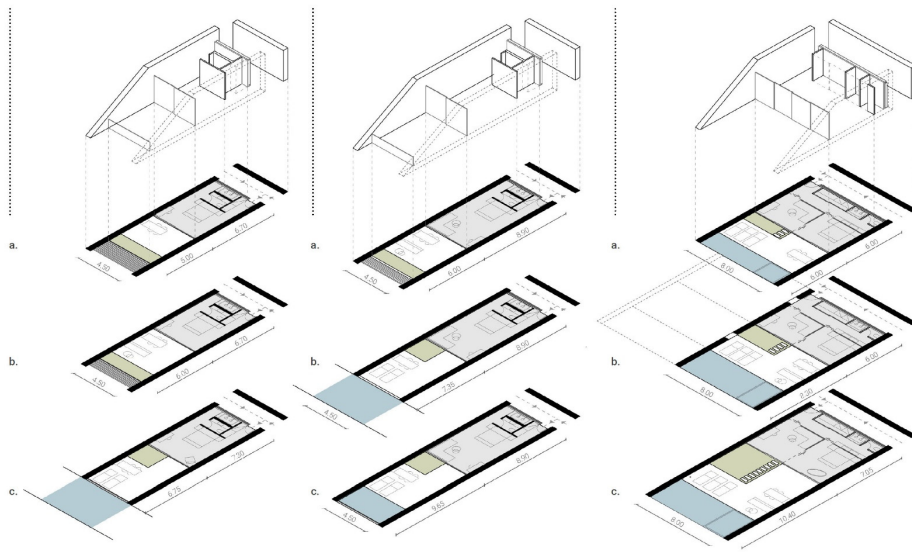


Figure 9: Rooms and suites typology diagrams. (Source: Alexandros Kitriniaris, KAAF (Kitriniaris Associates Architecture Firm), www.kaaf.gr. All rights reserved.)



Figure 10: Interior views of the rooms and suites. (Source: Alexandros Kitriniaris, KAAF (Kitriniaris Associates Architecture Firm), www.kaaf.gr. All rights reserved.)

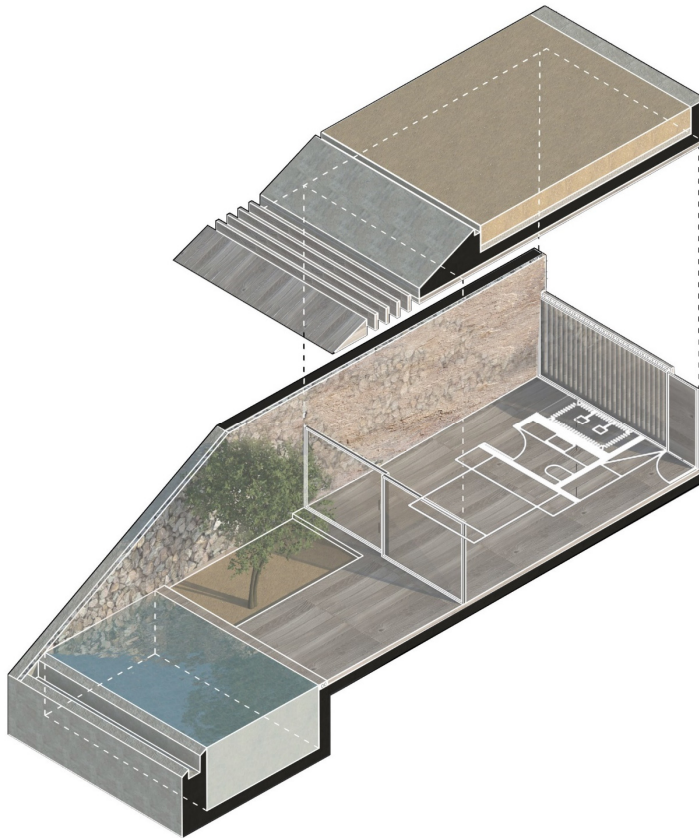


Figure 11: Materiality diagram. (Source: Alexandros Kitriniaris, KAAF (Kitriniaris Associates Architecture Firm), www.kaaf.gr. All rights reserved.)

4 SUSTAINABILITY TARGETS OF HOTELS AND RESORTS

1. Sustainable hotels cover operating costs over their lifetime and generate an acceptable rate of return, while developing long-term monitoring methods to evaluate whether expectations and goals have been met.
2. Sustainable hotels demonstrate flexibility to adapt to future changes of user needs, ownership, laws, regulations, and economic fluctuations. In this case they create inventive programming strategies in terms of use, multiplicity of functions, short-term flexibility, and long-term adaptability.
3. Sustainable hotels contribute positively to reducing emissions and to the overall CO₂ balance of a structure's use-cycle. This means will be integrated to healthier environment and have advanced financial benefits from government funding, stakeholders, and investors.
4. Sustainable hotels minimizing their ecological footprint and maximizing their positive impact on the environment; by the reduction of harm and increase of beneficial effects. This means that hotels could categorized to green labels and increase the number of visitors who are keen on sustainable strategies, especially, visitors on Northern Europe.

5. Sustainable hotels, include innovative concepts regarding design, integration of materials and methods, structure, enclosure and mechanical systems.
6. Sustainable hotels improve existing contextual conditions responding to the natural and built environment. This means that create an added value to the surroundings, enhancing the local economy as well.
7. Sustainable hotels contribute to the formation of socially viable environments, strengthening of shared values and empowerment of communities, as well as adhere to ethical standards in all phases of the project.
8. Sustainable hotels, needs political transparency, unbiased processes and commitment to principled interaction, just practices, all in the effort to prevent corruption at every level. This includes the participation of stakeholders, including users, clients, neighbourhood affiliations, local authorities and non-governmental organizations.
9. Sustainable hotels create architectural quality and aesthetic impact, specifically concerning space, land, spatial sequences, movement, materials, light and ambiance.
10. In a nutshell, it is to respect the heritage of the region, to use local materials and work with simple and reliable systems with low environmental impacts. This is summarized under the following three points:
 - Zero kilometres: Nearness of construction materials and local skills
 - Zero carbon dioxide: Energy management and lower emissions.
 - Zero waste: Lifecycle management in the building process and reuse of building materials.

REFERENCES

- [1] Palahí, M. et al., Investing in nature to transform the post COVID-19 economy. *Solutions Journal*, **11**(2), 2020.
- [2] Hetemäki, L., Hanewinkel, M., Muys, B., Ollikainen, M., Palahí, M. & Trasobares, A., Leading the way to a European circular bioeconomy strategy: From science to policy 5. European Forest Institute, 2017. DOI: 10.36333/fs05.
- [3] Durrell, L., *Spirit of Place: Letters and Essays on Travel*, Faber & Faber: London, 1969.
- [4] Majumdar, B., How hospitality will become more sustainable in 2020. Multibriefs, 2020. <https://exclusive.multibriefs.com/content/how-hospitality-will-become-more-sustainable-in-2020/travel-hospitality-event-management>. Accessed on: 20 May 2022.
- [5] World Tourism Organisation, <https://www.unwto.org/en>. Accessed on: May 2022.
- [6] Sustainable Development Goals, <https://sdgs.un.org/goals>. Accessed on: May 2022.
- [7] Paris Agreement, <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>. Accessed on: May 2022.
- [8] Bohdanowicz P. et al., Energy efficiency and conservation in hotels: Towards sustainable tourism. *4th International Symposium on Asia Pacific Architecture*, April 2001.
- [9] Jentsch, E., *Zur Psychologie des Unheimlichen*, 1906.
- [10] Freud, S., *The Uncanny*, translated by McLintock, D., Penguin Classics, 2003 (original 1919).
- [11] Blanning, T., *The Romantic Revolution*, Phoenix, 2010.
- [12] Norberg-Schulz, C., *Genius Loci, Towards a Phenomenology of Architecture*, Rizzoli: New York, 1980.
- [13] Benjamin, W., *Charles Baudelaire: A Lyric Poet in the Era of High Capitalism*, Verso Books, 1997 (original 1969).
- [14] Heidegger, M., *Sein und Zeit*, 1927. (Being and Time, translated by Joan Stambaugh, State University of New York Press, 1996).



- [15] Heidegger, M., *Essay on Building, Dwelling, Thinking*, 1951.
- [16] Heidegger, M., *The Thing*, 1950.
- [17] Vidler, A., *The Architectural Uncanny: Essays in the Modern Unhomely*, MIT Press, 1992.
- [18] Tzara, T., D'un certain automatisme du goût. *Minotaure*, **3–4**, 1933.
- [19] Kiesler, F.J., *Endless Space*, Hatje Cantz Publishers, 2001.
- [20] Freud, S., *The Uncanny*, Vol. XVII, The Hogarth Press: London, 1919.
- [21] Konstantinidis, A., Vessels for life or the problem of a genuine architecture. *Architecture Subjects*, Greece, 1972.
- [22] Designers and Specifiers, International Mass Timber Report, Chapter 5, Embodied Carbon and Biogenic Carbon, 2022.

