THE EXTERNALITIES OF CONTEMPORARY ARCHITECTURE IN TERMS OF SUSTAINABILITY

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Abstract
At a time of energy transition, how can contemporary architectural design contribute to United Nations Agenda 2030 for Sustainable Development (2015) and the New European Bauhaus (NEB) which aims at transforming the European Green Deal's goals into tangible, positive experiences for the citizens?

Many contemporary green building rating tools and sustainability metrics have limitations in driving truly sustainable outcomes. Focusing narrowly on energy efficiency without considering the whole life cycle and broader environmental and social impacts can lead to suboptimal results. Knowing that the building industry is one of the major contributors to climate change, sustainable building design has to move from an energy efficiency-centered approach to a people-centered experience trying to link sustainability rating systems with the comfort of occupants and the conservation of natural resources. Buildings can act as significant catalysts for improving or degrading the quality of life and the environment.

This paper investigates the externalities of contemporary architecture in terms of sustainability. Mapping these externalities and shedding light on good practices is crucial for integrating sustainability into planning and helping the decision - making process to contribute to the transformation of the built environment for as many people as possible and for as long as possible. The collection of relevant data on design and construction of sustainable buildings will help establish design as a decisive factor for reducing carbon footprint and implementing design disciplines to confront contemporary problems such as climate change, access to resources, health and wellbeing. This research underlines the need for an integrative, multidisciplinary approach that sees architectural design not just as a technical or aesthetic endeavor, but as a driver of societal and environmental wellbeing.

Key words: *Architecture, sustainability, externalities*

Introduction

Sustainable development in architecture focuses on creating buildings and infrastructure that meet present needs without compromising the ability of future generations to meet their own needs. This approach seeks to minimize environmental impact, enhance social wellbeing, and maintain long-term economic viability. According to the Davos Declaration (2018) the foundation of the Environmental, Social and Governance (ESG) standards in the built environment lies in the commitment to environmental protection -including addressing climate change- and in creating assets that are sustainable across all dimensions. In alignment

with the Sustainable Development Goals of the United Nations' Agenda 2030, the European Union has committed to reducing greenhouse gas emissions to net zero by 2050, ensuring a just transition to a carbon-neutral economy that benefits all citizens and regions, while fostering sustainable growth. Within this context, the NEB initiative (European Commission, 2021) aims to unite the goals of the European Green Deal (European Commission, 2019) with principles of aesthetics and inclusiveness. Recognizing the worldwide urge for a transition towards greener, sustainable, beautiful and inclusive built environments – as validated by the UN Agenda 2030 and the NEB - this paper explores the externalities of contemporary architecture in terms of sustainability.

The externalities of contemporary architecture in terms of sustainability

Buildings are worth more than three times the size of global Gross Domestic Product (GDP) (Tostevin and Rushton, 2023). But while expenditure on contemporary architecture is quantitative and easy to calculate in monetary terms, the benefits of architecture as cultural good extend far beyond financial value. These include aesthetic, symbolic, social, educational, environmental, scientific and other values, many of which are inherently hard to measure (Throsby D, 2001). Even when buildings are owned and used by individuals or small groups, the impact is spread all over society and the economy because the built environment affects us all! In this sense, architecture can serve as a significant catalyst for improving or degrading the quality of life and the environment in many ways.

The building sector is one of the major contributors to climate change, being responsible for over 34% of energy demand, around 37% of energy-related CO_2 emissions globally, half of all raw material extraction, one-third of water consumption and one-third of waste generation. Rapid urbanization further exacerbates the situation, as cities and metropolitan areas are responsible for about 70 % of global carbon emissions and consume more than 60 % of available resources. Many impacts of contemporary architecture involve what economists call externalities: benefits or social costs arising as a result of a private activity for parties not included in this activity.

There can be positive externalities as well. For example, buildings designed with sustainability in mind can yield positive effects. For instance, buildings designed with sustainability in mind - prioritizing recycled, local, low carbon, energy-efficient materials aligned with eco-design can affect people and the environment in a positive way. It is becoming apparent that when creating beneficial externalities, the interest of society extends beyond the wellbeing of the direct users, the buyers and the sellers, to also include other people who are indirectly affected, the broader community and future generations. Beyond environmental concerns, architecture also generates social and cultural externalities. Thoughtfully designed buildings and public spaces can foster inclusiveness, accessibility, and a sense of community, thereby improving social cohesion and public health (Gehl, 2011). Health-related benefits such as improved indoor air quality, access to natural light and green spaces further contribute to both physical and mental wellbeing (Evans, 2003). Culturally, adaptive reuse projects that preserve historical architecture help strengthen local identity and community resilience.

Given the significance of these multifaceted externalities, it is essential to adopt a holistic, multidimensional approach to analyzing contemporary architecture. Such an approach must account not only for energy performance and material efficiency but also for long-term environmental, social, and economic impacts. Mapping these externalities helps identify best practices and informs policy and design decisions that contribute meaningfully to sustainable development. Ultimately, architecture has the potential to play a transformative role in shaping a more resilient, inclusive and ecologically balanced built environment.

Contemporary architecture paradigms and sustainability

Sustainable development in architecture involves designing structures that are energy-efficient, resource-conscious and supportive of both environmental and social well-being. One of the most effective strategies in this context is adaptive reuse, which focuses on repurposing existing buildings and infrastructure rather than resorting to demolition and new construction. By transforming a building's function—through spatial reconfiguration or architectural blending of old and new—resources are conserved, construction waste is minimized, and cultural heritage is preserved, while also helping to limit urban sprawl. Furthermore, incorporating reclaimed or reused materials into new designs not only reduces embodied carbon but also adds aesthetic character and uniqueness. Innovative approaches such as modular construction, including the use of shipping containers, support flexibility, ease of maintenance, and the potential for future reuse in response to evolving community needs. In parallel, the integration of green infrastructure such as tree planting offers a range of social, environmental, and economic benefits, including the mitigation of the urban heat island effect, the reduction of pollution, and enhancement of biodiversity. These principles can be seen in various architectural examples that successfully balance innovation with sustainability.

Grand Park Bordeaux, Lacaton & Vassal + Frédéric Druot + Christophe Hutin architecture, 2016

Prioritising the rehabilitation of three modernist social housing's buildings from the early 60's, architects Anne Lacaton and Jean-Philippe Vassal improved the living conditions and comfort of the residents, while also producing environmentally better-performing dwellings and improving the image of urban housing. Following their motto "never demolish, never remove or replace, always add, transform and reuse", the architects added large winter gardens and balconies in extension of the existing structures, offering each apartment more space, natural light, flexibility of use and wider views. The addition of winter gardens also served as passive solar collectors, improving the energy performance of the building and reducing energy consumption by about 60%.

To complete the transformation in just 12-16 days per apartment, allowing families to stay in their dwellings during the construction works, the architects used prefabricated modules assembled in front of the buildings, with poured concrete used only for foundations. The renovation cost around €50,000 per unit - half as much as a new-build scheme - saving approximately €26,5 million in total. As Lacaton stated, 'Sustainability is also about the way that money is spent on doing something that lasts longer and is of greater use.'

The French duo reexamine sustainability through their reverence for pre-existing structures, conceiving projects by first taking careful inventory of what already exists. Lacaton emphasizes, "Transformation is the opportunity of doing more and better with what is already existing. The demolishing is a decision of easiness and short term. It is a waste of many things—a waste of energy, a waste of material, and a waste of history. Moreover, it has a very negative social impact. For us, it is an act of violence." (Lacaton A., 2021). For their pioneering work Anne Lacaton and Jean-Philippe Vassal were awarded the Pritzker Architecture Prize.

Redevelopment and reconstruction Munich Re, Sauerbuch Hutton, 2014

The redevelopment and reconstruction of an existing dark office block of the 1980s by removing sections in its core and enabling natural ventilation and more natural daylight, reduced energy consumption and enhanced occupant comfort. The reuse of the building also involved the renewal of the façade which not only revitalized the building's appearance and the surrounding environment but also improved thermal insulation, solar control and noise

reduction contributing further to lower energy consumption (Sauerbuch Hutton, 2014). It was estimated that by retaining and upgrading the existing structure, enough energy was saved to heat the building for approximately 34 years.

Dexamenes Seaside Hotel in Kourouta, K-studio, 2018

An abandoned wine factory was revived and transformed into a resort. The existing concrete blocks of wine tanks were preserved and adapted into hotel rooms by removing slices of the tank walls to create doorways. These thick concrete slabs were then placed in a shallow pool in courtyard between the two blocks of tanks, forming stepping-stones that lead to two preserved steel silos. These circular silos now host art installations, spa treatments and private dining experiences (Pintos P., 2020). The shallow pool also contributes to the microclimate of the hotel. Although originally built for industrial use, the project successfully preserved the character and atmosphere of the historic structure.

Design of the area around the Acropolis and the Philopappou Hill in Athens, Pikionis, 1959

A Greek paradigm with great impact over time is the design of the area around the Acropolis and the Philopappou Hill, which has been declared a Monument of Modern Architecture of World Importance since 1996 (UNESCO) and the construction of the church of St. Demetrius Loumbadiaris, which at the end of works, in 1958, was declared a historical preserved monument, and have been awarded international awards from time to time. Dimitris Pikionis has given new life to the materials that come from massive demolitions of neoclassical buildings in the surrounding area. By reusing older stone, marble and ceramic fragments and composing them with concrete and modern brickwork seeks to artfully integrate the history of the site with the natural landscape and the more recent history. A logical "collage of the past and the present" (Antonakakis D., 1987) aimed at creating a new distinctive and balanced composition, without destroying the value of the elements that make it up.

APROP Ciutat Vella Emergency Housing in Barcelona, Straddle3 + Eulia Arkitektura + Yaiza Terré, 2019

The APROP Ciutat Vella Emergency Housing project questions the need for constructing new assets, especially when pre-existing structures are available for repair or upgrade. Serving as a shelter for residents who have suffered eviction, it was built within their own neighborhood using recycled industrial discarded containers, that were given a second life. From a sustainability perspective, the ecological footprint of a container-based apartment building is significantly lower than of a conventional residential building. These structures do not require the extensive use of reinforced concrete, are transportable, can be quickly assembled into settlements and are easy dismountable and adaptable to new sites. This approach reduces both the energy required and the waste generated during demolitions. Furthermore, all dwellings have at least two facades, allowing for natural cross ventilation and special attention was paid to thermal insulation to optimize energy performance, achieving double A (AA) energy certification (Ott C., 2019). In this way, this housing model not only addresses urgent housing needs but also offers a socially responsible and ecological sustainable alternative that could influence future housing policies.

Vertical Forest Milan, Boeri Studio, 2014

Integrating green elements in contemporary architecture such as tree planting can have numerous positive effects on the overall building performance, on the surrounding neighborhood and on the environment. Green contributes to improved air quality, reduced energy consumption, enhanced mental health, and at the same time contributes to a more

livable, resilient urban environment by moderating the heat island effect and lowering the overall environmental impact of buildings. The two towers feature as much vegetation as is normally found on around 30,000 m2 of forest. The plants create an optimal microclimate; they also regulate humidity, carbon dioxide absorption, and produce oxygen. The vertical forest has become a habitat for a number of animal species, birds and butterflies (Stefano Boeri Architetti, 2014). The screen of leafy green trees not only reduces the need for air conditioning to heat and cool the tower's apartments, but also create a self-sufficient ecosystem.

Tamedia Office Building Zurich, Shigeru Ban Architects, 2013

Shigeru Ban, well-known for his innovative use of paper and paperboard, has designed an office building in Zurich made entirely of wood —specifically, 2,000 cubic meters of Austrian spruce, following Japanese construction traditions. The structure is composed exclusively of prefabricated, precision-milled timber elements, which were assembled on site. Timber, when sourced from sustainably managed forests, is an environment-friendly, renewable construction material offering a significantly lower embodied carbon footprint compared to conventional construction materials like concrete and steel. In addition to its environmental benefits, timber is known to have a positive impact on both physical health and psychological wellbeing. The building operates entirely CO_2-free, utilizing geothermal groundwater for heating and cooling, without reliance on fossil fuels. Furthermore, high quality thermal insulation combined with the use of heat pumps ensures that the operational costs of this carbon-neutral wooden building remain low (Shigeru Ban Architects, 2013).

Sustainability metrics

While environmental issues caused by the building sector show that green building design and construction is not an alternative, but a necessity, a precise definition of a broadly "sustainable" or "green" building does not exist yet. A series of green or sustainable building certification systems have however emerged over the past decades to provide to market actors recognized evidence of the quality of a building from a sustainability viewpoint. Building Research Establishment Environmental Assessment Method (BREEAM) which is adapted to European regulations and the Leadership in Energy and Environmental Design (LEED) which is U.S. centric are the most widely recognized sustainability rating systems around the world, focusing on a wide range of criteria. The LEED certification evaluates land use, water, energy and emissions, materials, indoor environmental quality, and innovation. BREEAM assesses project management, energy, health and wellbeing, transport, water, materials, w aste, Land use, and Pollution. Applying for and obtaining certifications increases the cost of the investment but certified buildings can often provide increased return on investment, lower vacancy rates, enhanced brand reputation and visibility, maintenance and operational cost savings and potential tax incentives (UCEM, 2024).

But could the aforementioned projects or smaller renovation projects receive any of these certifications? On the other hand, many projects might appear extremely sustainable at a superficial level but are all these projects actually "green" with their overall context – physical, economic, social, etc.?

Bloomberg's New European Headquarters in London, Foster + Partners

Bloomberg's New European Headquarters in London, designed by Foster + Partners achieved an Outstanding rating according to the BREEAM sustainability assessment method - the highest design-stage score - and has garnered significant international attention and awards (Foster + Partners, 2017). Compared to a typical office building, it saves 73% in water

consumption, uses 40% less energy for lighting, features a 'smart' CO_2-control system that dynamically adjusts airflow, and operates a combined heat and power generation system estimated to reduce CO_2 emissions.

While these green features have undoubtedly set new standards on sustainability, they have not been sufficient to prevent criticism regarding its designation as the world's most sustainable office building. The use of 600 tons of bronze imported from Japan, 10,000 tons of granite from India, and serrated glass imported from China raised questions about the sustainability of the construction process itself. Furthermore, while the combined heat and power generation center is more efficient than a conventional system, it still burns natural gas, contributing substantially to the building's total embodied carbon footprint.

One of the chief criticisms of standards like BREEAM and LEED is their focus on operational carbon emissions - the emissions produced during the building's usage - excluding most of the embodied carbon emissions generated during construction, which can account for approximately half of a building's lifetime CO_2 emissions (Waugh A., 2021). This focus encourages the designers to add unnecessary "systems" to achieve high ratings since mechanically-cooled buildings is easier to achieve higher ratings than naturally ventilated ones. This means air conditioning can be favoured over simple design solutions like operable windows (UCEM, 2024). Although BREEAM and LEED have made modest updates to include embodied carbon considerations, significant gaps remain.

PowerHouse Kjørbo in Oslo, Snøhetta, 2014

An exemplary case of sustainable building design that integrates sustainability rating systems with the conservation of natural resources is PowerHouse Kjørbo, located outside Oslo and designed by Snøhetta. This project demonstrates the feasibility of transforming two existing office buildings, originally constructed in 1979, into energy-positive structures. Adopting a holistic approach, the renovation process simultaneously addressed architectural quality, energy efficiency, choice of materials, embodied carbon, and building systems—ultimately aiming to produce more energy than the buildings consume. A key objective was the reuse of materials and the selection of environmentally friendly construction alternatives, while preserving the buildings' original structural identity. The design incorporated a ground-source heat pump system in combination with a highly efficient ventilation strategy. Photovoltaic panels were installed on the roofs, and the interiors were designed to maximize natural daylight, enhancing both energy savings and visual comfort. Notably, the project became the first rehabilitation initiative worldwide to achieve the highest possible rating in the BREEAM-NOR certification system (85.2%), earning both national and international recognition, as well as multiple awards (Snøhetta, 2014).

Conclusions

Currently, the bar for sustainability is so low that often the "sustainability part" is completely ignored or the designers at the end just add a green roof or tons of solar panels just to tick off a check-list, without caring about solar panels after their 25-year-long life-span. On the other hand, while green building certifications undoubtedly have played a significant role in shaping sustainability discourse and influencing practices within the construction sector, their application is not without limitations. Even though they have evolved to integrate factors such as embodied carbon, they should not be followed blindly. Certifications may fail to reflect the full environmental footprint of a building and frequently neglect broader ecological and social implications. Furthermore, their rigid frameworks can inhibit recognition of innovative design solutions that deviate from established benchmarks yet achieve superior sustainability outcomes. In response to such limitations, the European Commission has introduced an

evidence-based scientific handbook aimed at evaluating the built environment through the three core dimensions of the New European Bauhaus initiative – sustainability, aesthetic value and inclusiveness (Lourenço, P. et al., 2024).

Despite the challenges and the negative externalities associated with contemporary architectural practices, sustainable design holds significant transformative potential. Mapping the externalities of contemporary architecture which embodies sustainability into planning is crucial for creating a truly holistic approach to design, one that considers the long-term environmental, social, and economic outcomes. Such an approach can guide decision-making processes to contribute to the transition toward a built environment that is not only resilient and inclusive, but also beneficial to as many people as possible, for as long as possible. Ultimately the highest ambition of sustainable architecture is to regenerate and reconnect to nature (European Commission, 2024), taking the stepfrom a human-centred to a life-centred perspective.

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