Evaluation of Sustainable Architecture Principles Application in Recycling Mall (Case Study: ReTuna Återbruksgalleria)

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Abstract. This study examines the role of sustainable architecture in waste management, using Sweden's ReTuna Återbruksgalleria, a recycling mall, as a key example. It highlights how sustainable design can address environmental issues by incorporating urban ecology, energy conservation, water management, waste reduction, and community engagement. ReTuna is celebrated for its innovative approach to reducing waste, repurposing materials, stimulating the economy, raising environmental consciousness, and collaborating with locals. The research delves into sustainable architecture's complexities, especially in waste management, by reviewing extensive literature to offer a comprehensive view. It underscores the importance of eco-friendly practices beyond academic circles, aiming to motivate various sectors to act. The insights gained aspire to shape a globally sustainable, environmentally mindful built environment.

1 Introduction

Sustainable architecture has emerged as a critical discourse in the global quest for harmonious coexistence between humanity and its natural environment. Rooted in principles of sustainability, this architectural paradigm transcends mere material choices, extending to encompass broader considerations such as energy efficiency, waste management, and the integration of spaces that resonate with nature[1]. This holistic approach underscores the importance of designing structures that not only meet human needs but also minimize environmental impact and promote long-term ecological balance.

At the heart of sustainable architecture lies the careful selection and utilization of eco-friendly materials. This entails incorporating recyclable or biodegradable materials while minimizing the use of substances that may harm the environment. Additionally, considerations such as the transportation distance of materials are crucial to reduce carbon emissions associated with transportation, thereby furthering the sustainability agenda[2].

Moreover, energy efficiency stands as a cornerstone of sustainable architectural design. By harnessing cutting-edge technologies, architects can reduce energy consumption within buildings through the integration of solar panels, passive solar design strategies, natural lighting systems, and efficient building insulation. Through these measures, architects can significantly mitigate the carbon footprint of buildings and mitigate adverse environmental impacts[3].

Waste management represents another vital aspect of sustainable architecture. Structures must be equipped with systems that enable efficient waste management, including the deployment of eco-friendly sanitation facilities, rainwater harvesting systems, and effective waste segregation mechanisms. Through the integration of these systems into building designs, architects can minimize the volume of waste generated, thereby extending the overall lifecycle of structures[19].

In the context of sustainable architecture, social and cultural considerations are also paramount. Buildings should be designed with sensitivity to user needs and comfort, while fostering social inclusion and community participation. This inclusive approach not only enhances the usability of spaces but also fosters a sense of ownership and stewardship among users, contributing to the long-term sustainability of built environments[20].

The next thing that is interesting to study is how the existence of these recycling-based economic centers. In addition to being places that sell goods that apply the principle of sustainability, do the architectural designs of these centers also apply the principle of sustainability that encourages energy efficiency, ease of access, and friendliness that can be interpreted as not adding pollution to the environment? The spirit of establishing sustainability-based economic centers for used goods must be in line with the design of the centers themselves that are in favor of sustainability. One promising approach is to integrate the principles of sustainability in architectural design. This involves the wise use of environmentally friendly materials, the implementation of energy-saving technologies, and the adoption of waste management strategies that aim to reduce the environmental footprint. Essentially, sustainable architecture seeks to create a built environment that is harmonious with nature while addressing the pressing problem of waste production.

An exemplary case study that exemplifies the principles of sustainable architecture is ReTuna Återbruksgalleria, a recycling mall located in Eskilstuna, Sweden. ReTuna is the world's first shopping center entirely dedicated to recycled and upcycled goods. Beyond its retail function, ReTuna

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embodies sustainable architectural principles by incorporating eco-friendly materials, energy-efficient systems, and innovative waste management solutions into its design. Moreover, the mall serves as a community hub, offering workshops, educational programs, and events that promote environmental awareness and sustainable living practices among visitors.

This paper presents a research that has substantial significance in a broader context. Focusing on the specific case of ReTuna Återbruksgalleria as a recycling center, the aim of this research is to reveal the complex interactions between sustainable architectural practices. Through an approach that involves two perspectives, this research analyzes various aspects of sustainable architectural development. A literature study method is used to explore the references that support this research holistically.

2 Sustainable Architecture

Sustainable architecture is an architectural concept that implements environmentally friendly development. This concept aims to meet the needs of the building occupants without compromising the ability of future generations to meet their own needs. These needs may vary depending on the society and region concerned[4].

Sustainable architecture is also a way to reduce the negative impact on the environment from development by using materials, energy, and space efficiently and wisely. This requires awareness and concern for the environment in designing buildings[5]. In addition, the threat to the environment is not only caused by human actions, but also by the explosion of human population especially in developing countries with low living standards[6]. Sustainable architecture not only pays attention to the sustainability of the users, but also the nature and environment around the building. This principle is very needed by our earth today, and requires collective awareness to realize sustainable architecture and not just pursue profits. Sustainable architecture can provide long-term benefits for us all without eliminating the beauty and aesthetics of the building. That is all the goal to save the earth and the environment where we live today[7].

2.1 Principles of Sustainable Architecture

In Ardiani's book "Sustainable Architecture"[8], Sustainable architecture is an architectural concept that implements environmentally friendly development principles. These principles cover various aspects such as urban ecology, energy strategy, water management, waste management, material usage, environmental community, economic strategy, cultural preservation, and operational management. For example, urban ecology stresses the interdependence of ecosystems to ensure the continuity of natural life for future generations, while energy strategy seeks to reduce energy consumption by recycling and using renewable energy sources.

Furthermore, water management aims to preserve water resources and optimize water usage by applying recycling methods, and waste management entails reducing, managing, and recycling waste materials to lessen environmental impact. Material usage favors environmentally friendly and recyclable materials, ensuring safety and comfort for building occupants. Moreover, principles such as economic strategy highlight the importance of supporting small businesses to enhance economic stability and sovereignty, while cultural preservation emphasizes protecting cultural heritage to foster sustainability. Finally, operational management underscores the importance of residents' knowledge and participation in maintaining building systems and technologies for optimal functionality. These principles collectively lead to the achievement of sustainable architectural designs and practices, ensuring a harmonious relationship between human habitation and the environment.

Sassi[6] proposes six fundamental principles of sustainability based on observations of various case studies applying sustainable concepts. These principles consist of land use, energy, water, material, health, and community. Land use deals with the vital need for land in human activities and pursuits, with population growth creating difficulties for land sustainability. Energy consumption affects sustainability significantly, especially regarding global warming, with prudent consumption and use of renewable energy considered essential solutions. Water, indispensable for most living beings, suffers from quality deterioration and shortage due to improper waste management and environmental factors, aggravating water-related problems globally. Material consumption impacts environmental sustainability, with non-renewable materials causing environmental damage and processing releasing harmful emissions, highlighting the importance of sustainable material selections. Health and well-being are important aspects, with building designs adopting green concepts to reduce health-related problems such as poor air quality and insufficient lighting. Community sustainability is vital, incorporating previous aspects and stressing social integration through shared spaces and fostering awareness of sustainability concepts among individuals.

3 Recycling Mall

Recycling, as explained by[9] involves the systematic gathering, treatment, and processing of used or discarded materials resulting from both production and consumption processes. This multifaceted approach seeks to transform waste substances without changing their intrinsic structure or composition, making them suitable for further use. The main goal of recycling is to reduce environmental impact by limiting the need for raw materials extraction and decreasing the amount of discarded materials, thereby supporting sustainable
resource management. This cyclical process is consistent with the wider ethos of ecological preservation and resource efficiency, representing a mindful response to the increasing challenges caused by contemporary patterns of consumption and production.

Many viewpoints suggest that waste is an unavoidable outcome resulting from the resource transformation processes inherent in our economic system [10][11]. Therefore, efforts aimed at waste reduction and reintegration of waste into the economic cycle, often referred to as ‘closing the material loop’ or recycling, emerge as essential components within a comprehensive approach to resource management [12]. From this perspective, a nuanced understanding of the recycling paradigm is achieved by examining the term’s definition, wherein ‘recycling’ is clarified as the ‘reintroduction of discarded materials into the production process so that they can be reformulated into new products’[13].

The traditional approach to product disposal outlines a linear flow wherein waste materials are sent to landfills or randomly discarded [14][15]. Thus, for recycling to be sustainable, an accessible market for recycled materials at the end of the cycle is crucial [12]. Marketing intermediaries also produce waste following this path, and the holistic consequences of directing materials through resource recovery go beyond resource conservation to the reduction of lasting pollution from uncontrolled landfill use.

In summary, a paradigm shift towards sustainable recycling not only protects resources but also reduces persistent pollution resulting from unregulated landfill practices. This highlights the imperative of creating accessible markets for recycled materials, thereby promoting a closed-loop system that supports the continuity of recycling efforts.

3.1 ReTuna Återbruksgalleria

ReTuna Återbruksgalleria is the world’s first mall of recycled goods, transforming shopping into a climate-friendly activity[16]. Old items are revived through repair and upcycling. Everything sold is recycled or reused or has been produced organically or sustainably. Moreover, the design features a dynamic spatial arrangement that surpasses conventional retail models. Different zones within the complex are arranged with care, creating an engaging experience for visitors who explore the hallways full of recycled treasures. The architectural layout fosters a symbiotic relationship between consumer and reclaimed product, thus giving shopping a deep sense of ecological awareness.

The design of ReTuna Återbruksgalleria is a proof of the convergence of design innovation and sustainable consciousness. It challenges the traditional view of consumerism by elevating recycled artifacts to a higher level of aesthetics. This architectural project, based on ecological responsibility, invites us to rethink our relationship with materiality, showing how architectural interventions can go beyond mere buildings to become drivers of paradigm shifts in societal perceptions and behaviors[17].

3.1.1 Sustainability Study of ReTuna based on Ardiani’s and Sassi’s Perspective

ReTuna Återbruksgalleria is a prime example of sustainable architecture as it positively contributes to various aspects of sustainability, including waste management, material reuse, local economy, and environmental awareness within the community. The presence of ReTuna as a mall that promotes the implementation of sustainability aspects will be analyzed through the approach articulated by Ardiani[8] and Sassi[6] as follows.

3.1.1.1 Urban Ecology

The mall, ReTuna Återbruksgalleria, plays a significant role in Eskilstuna, Sweden, not only as a retail center but also as a catalyst for reducing waste and promoting sustainability through its innovative approach to old items. By refurbishing and upcycling old goods, the mall actively contributes to the circular economy, where resources are utilized more efficiently and waste generation is minimized. This initiative aligns with the principles of urban ecology, a key aspect of sustainable architecture, which emphasizes the interconnectedness between urban environments and ecosystems. Through its activities, the mall fosters a more sustainable urban ecosystem by reducing the demand for new resources and minimizing the environmental impact associated with waste disposal. Additionally, by serving as a public education venue on sustainability and circular economy practices, the mall raises awareness among visitors about the importance of responsible consumption and waste management, furthering the integration of sustainable practices into the local community and urban fabric.

3.1.1.2 Energy Strategy

ReTuna Återbruksgalleria, managed by Eskilstuna Energi och Miljö, is an innovative concept that combines shopping with sustainability and waste reduction. Specific information about the energy system.
used by this mall is not explicitly stated in the sources I found, so we cannot associate it with environmentally friendly energy strategies and sustainable design.

3.1.1.3 Water

The absence of documented details regarding the clean water management system at ReTuna Återbruksgalleria reflects a broader trend in sustainable architecture where environmentally friendly water management systems are often integrated into the design but not extensively documented. Sustainable architecture emphasizes the integration of green technologies and practices, including water conservation and management. Such systems could include rainwater harvesting, greywater recycling, and efficient water fixtures, all designed to reduce water consumption and minimize environmental impact. While specific details of these systems may not always be explicitly highlighted in literature, their incorporation into sustainable architectural design is fundamental to achieving environmentally responsible built environments.

3.1.1.4 Waste

The lack of literature documenting detailed waste management systems emphasized in the design of ReTuna Återbruksgalleria underscores the functional aspect where waste and recycling are central to its business model. ReTuna effectively turns waste and discarded items into a primary asset, as reflected in the goods sold within the facility, which are either recycled, reused, or produced using organic and sustainable methods. While specific architectural design features related to waste management may not be extensively documented, the operational focus of ReTuna on promoting a circular economy and sustainable consumption is evident in its core philosophy and business practices. This approach aligns with principles of sustainable architecture, where the integration of environmental considerations extends beyond physical design elements to encompass broader systemic approaches to resource management and conservation.

3.1.1.5 Material

ReTuna Återbruksgalleria's architectural design is deeply rooted in sustainable principles, evident through the utilization of innovative materials and design strategies. The exterior features container walls, a resourceful choice that repurposes shipping containers, highlighting the concept of adaptive reuse and reducing construction waste. Moreover, the extensive use of glass in the front facade not only enhances natural lighting but also fosters a sense of transparency, inviting visitors to connect with the surrounding environment. Inside, the mall's interior spaces are adorned with upcycled furniture and fixtures, each piece telling a story of transformation and sustainability. These elements collectively contribute to a visually striking environment that not only minimizes environmental impact but also serves as a beacon for sustainable design, inspiring visitors to reconsider their relationship with consumption and waste.

3.1.1.6 Environmental Community

The Environmental Community at ReTuna Återbruksgalleria serves as a focal point for sustainability initiatives and activities within the facility. This community encompasses a diverse range of stakeholders, including shoppers, vendors, local residents, and environmental organizations, all united by a common goal of promoting sustainable living practices. Through workshops, educational events, and collaborative projects, the Environmental Community engages participants in discussions and actions aimed at reducing waste, conserving resources, and fostering environmental stewardship. By fostering a sense of belonging and shared responsibility, the Environmental Community plays a vital role in nurturing a culture of sustainability within ReTuna Återbruksgalleria and the broader community it serves.
3.1.1.7 Economic Strategy

ReTuna Återbruksgalleria, is the world’s first mall dedicated to recycling and reusing. This innovative mall opened its doors in 2015 and has transformed the shopping experience by prioritizing refurbished and upcycled products. Here are some of the economic strategies implemented by ReTuna Återbruksgalleria:

a. Organic and Sustainable Products: Every item sold in the mall is either produced organically or with a focus on sustainability. This includes products that have been repaired or repurposed from existing materials.

b. Store Variety: The mall offers a variety of shops, including building material and interior outlets, flower shops, toy stores, furniture shops, and vintage clothing stores. All these stores exclusively sell pre-owned items.

c. Recycling Containers: Community members can drop off their used items in recycling containers provided by the mall. These items are then redistributed to the various stores within the mall.

d. Events and Seminars: ReTuna Återbruksgalleria hosts workshops and seminars to raise awareness about sustainability and the circular economy.

e. Educational Role: The mall serves not only as a shopping destination but also as an educational hub for the community, promoting sustainable practices and circular economy principles.

Thanks to this innovative approach, ReTuna Återbruksgalleria achieved SEK 14.7 million in recycled product sales in 2019 and created over 50 new jobs in the area.

3.1.1.8 Cultural Preservation

Cultural preservation at ReTuna Återbruksgalleria manifests through its promotion of traditional craftsmanship and heritage appreciation. By incorporating upcycled goods and locally sourced materials, the mall honors local artisanal traditions and reduces the environmental impact associated with mass production. Additionally, ReTuna provides a platform for local artisans and craftsmen to showcase their skills and products, preserving cultural heritage while fostering community engagement and economic opportunities. Through events, workshops, and educational programs, ReTuna encourages visitors to learn about the cultural significance of sustainable practices and the value of preserving traditional crafts in a modern context.

3.1.1.9 Operational Management

Operational management at ReTuna Återbruksgalleria is characterized by a holistic approach to sustainability and community engagement. This involves efficient resource utilization, waste management, and customer service. The facility emphasizes the reuse and recycling of materials throughout its operations, from construction to daily activities, minimizing environmental impact. Additionally, ReTuna fosters a vibrant community atmosphere by offering diverse events, workshops, and educational programs focused on sustainability and environmental awareness. Furthermore, the mall maintains strong partnerships with local businesses, artisans, and environmental organizations, enhancing its impact and outreach within the community. Through effective operational management, ReTuna Återbruksgalleria successfully integrates sustainability into its core functions while providing a unique and engaging experience for visitors.
3.1.1.10 Health and Well-being

ReTuna Återbruksgalleria realizes the goal of Health and Well-being by offering recycled goods with new value, thereby reducing waste and fostering a healthier and more prosperous human life in the future. By promoting the reuse and repurposing of items, ReTuna minimizes the environmental impact of production and consumption, contributing to cleaner air, land, and waterways. Additionally, by encouraging conscious consumption and community engagement, the mall creates a sense of empowerment among individuals, leading to greater overall well-being. Through these efforts, ReTuna not only addresses immediate environmental concerns but also lays the groundwork for a sustainable and thriving future for generations to come.

However, to further strengthen its contribution to environmental sustainability, ReTuna must adopt a more proactive approach to waste management and water management. In terms of waste management, ReTuna can enhance the efficiency of its systems by implementing more environmentally friendly waste processing methods, such as more efficient recycling, more structured waste sorting, and the provision of composting facilities for organic waste. Additionally, water management at ReTuna can be improved by using technologies that reduce water consumption, such as rainwater harvesting systems and water-saving technologies in sanitation systems.

4 Conclusion

ReTuna Återbruksgalleria serves as a tangible model of sustainable architecture that effectively integrates various sustainability aspects. By incorporating waste management, material reuse, local economy, and environmental awareness within its community, ReTuna functions not only as a shopping center that prioritizes recycled products but also as an educational and activity center that promotes sustainable living practices among the public. Through its holistic approach, ReTuna makes significant contributions to the overall environment, economy, and welfare of the community.

Fig. 7. The workers at ReTuna are collecting recyclable materials at the return station

Fig. 8. ReTuna realizes the goal of Health and Well-being by offering recycled goods

References


