Ecological and Green Design Significances in Interior Spaces

GOZEN GUNER AKTAS
Interior Architecture and Environmental Design
TOBB University of Economics and Technology
Sogutozu cad. No:43 Sogutozu, Cankaya, Ankara
TURKEY
gaktas@etu.edu.tr

Abstract: - This study aims to evaluate the ecological and green design concepts in interior spaces. The role and the contribution of interior spaces and interior architecture to the ecological and green design will be discussed. Ecological and green design implementations will be figured out in the built environments. Contribution of interior architecture and interior design of the buildings to those concepts will be discussed. Interior design material, material selections, material applications and surface treatments systems in interiors will be introduced and their contribution to the building sector from ecological and green design approach will be discussed.

Key-Words: - Ecological, Green, Design, Materials, Interior Space.

1 Introduction
The concept of sustainability is one of the most frequent discussed subjects in the related fields with the build environment. The importance of the subject is increasing everyday; while the world population is increasing and the overall quantity of natural resources is decreasing [3, 4]. The conflict of this century is an increase in peoples’ life quality while a decrease in the overall consumption of natural resources. Ecological and green design ideologies are other significant titles that are directly related in within the concept of sustainability. It is estimated that the world’s population will almost double from the present 6.2 billion to around 8 to 10 billion by 2025 and as a consequence, will increase both the demand on resources as well as the environmental impact resulting from human activities. Since the earth is a closed ecosystem, it will not be possible to support such an exponentially increasing population within the traditional growth-oriented economic models [7].

Therefore, a shift in the current economic and socio-cultural framework is required: a transition from a traditional material and product paradigm to an emerging knowledge and service paradigm; a transition in which the research into sustainability shifts from a technological and product-related innovation process to a broader techno-socio-cultural process [6].

Interior Architecture and interior design discipline has an important role in construction sector to provide contribution to the ecological and green design concepts. This study aims to evaluate the ecological and green design concepts within the built environment discipline. Ecological and green design approaches in interior spaces will be discussed and the main contributions of the area with interior finishing materials and the surface treatment systems will be overviewed.

2 Concept of Ecologic and Green Design
The concept of ecological design in the sector of construction is defined as; “the creation and responsible management of a healthy built environment, based on the efficient use of resources and on ecological principles” by Scott in 1999 [12]. Ecological and Green design in the construction industry works for the present and future improvement in the life quality [5].

This requires the characterization of materials from an ecological point of view, a complex operation under the conditions in which the environmental impact of building materials is difficult to assess, mainly due to the numerous different problems to be taken into consideration and to the fact that the data available are frequently inadequate for an accurate evaluation [14].

Basic principles that underlie ecological and green design in construction industry can be listed as:
1. Saving of existing material resources;
2. Maintenance of a clean and healthy environment both in terms of topographic changes and the degree of air, water and soil pollution;
3. Reduction of the embodied energy in buildings;
4. Measures regarding the diminution of heat losses;
5. Provides an optimal ratio between the surface of the envelope and the building volume;
6. Contributes the thermal insulation of the closing elements of a building (exterior walls, floors, roofs);
7. Ensuring of adequate thermal inertia;
8. Contributes the creation of insulating spaces between environments with different temperatures (buffer spaces in attics, basements, staircases, etc.);
9. Requires more efficient installations and equipments;
10. Provides hierarchy of spaces requiring different temperatures and their orientation in relation to the cardinal points;
11. Requires use of renewable energy sources (solar, geothermal energy);
12. Provides optimization of natural ventilation;
13. Encouragement of investments for the conservation of energy;
14. Provides and increased awareness of users, adoption of more rational building operation conditions [5].

Briefly ecological and green design can be defined as; any form of design that minimizes environmentally destructive impacts by emulating and integrating with natural ecosystems can be referred to as eco-design [6]. As such, eco-design seeks to provide a framework for an environmentally appropriate system of design and management by incorporating both anthropogenic and ecological values, at relevant spatial and temporal scales. The concept of ecological design involves several key aspects, such as:
• Meet the inherent needs of humans.
• Move toward resource sustainability.
• Maintain ecological integrity.
• Emulate natural ecosystems.

Design towards an integrated web of economic and ecological activities
Accommodate the natural regime of ecological stressors and disturbances
• Eliminate natural debt.
• Protect natural habitat.
• Increase environmental literacy.

The principles of ecological design can be applied within a continuum of spatial scales, ranging from individual homes, to neighborhoods and industrial parks, as well as to particular manufactured products [7].

Ecological and green design can be applied to both the improvement of existing urban areas and communities, as well as planning for new ones. Improvements of existing areas begin with the identification of such environmental problems as inefficiencies of use of materials and energy environmental pollution, and conflicts with indigenous biodiversity, followed by efforts at mitigation and restoration ecology [5].

Ecological and green design has the potential for developing environmental synergies through the coordination of economic activities among commercial or industrial enterprises. A key aspect of this design is the development of a web of enterprises connected to form an efficient and interdependent system, in which discarded materials and heat of processes are used as inputs to others [6].

Ecological and green design can also provide to minimize the use of land, conserve heat in winter and cool in summer, reduce emissions of pollutants, and naturalize the landscaping. The use of land can be optimized by designing multi-storied buildings instead of sprawling ones, and by efficiently allocating internal energy use can be decreased by using passive and active solar heating technologies in winter, shading and reflecting surfaces in summer, and efficient insulation, windows, lights, and appliances; externally, trees can be positioned to provide shade in summer and wind-shielding in winter; in some cases, low-grade “waste” heat from thermal power plants can be used in nearby buildings [14].

Building materials and furniture can be selected to be efficiently manufactured (in terms of the consumption of energy and material) from renewable resources, to be long-lasting yet readily reused or recycled, and to not emit indoor pollutants [7].

Locally traditional (or vernacular) design elements can be incorporated into buildings to improve their energy and material efficiency, aesthetics, and comfort, while also respecting cultural heritage. Emissions of wastes can be reduced [6].

Lanscaping can be naturalized by utilizing only native plants in horticulture, and by designing to simulate natural communities appropriate to local conditions, while respecting the need for pleasant aesthetics and low-impact recreational use [5].

Ecological and green design has been applied extensively to the development and manufacturing of certain products. With continuing increases in the human population and in industrial production and consumption, concerns have been raised about the environmental burdens associated with the extraction and harvesting of materials, the manufacturing of products, the use of the products and finally their recycling or disposal. Within this context, eco-design is recognized as a strategy that
can be applied to reduce the impacts associated with the production and consumption of products [14].

3. Ecologic and Green Approaches in Interior Spaces

In the concept of ecological and green design in built environments, interior spaces have a great significance as they are the main shelters of the individuals [2]. Using the basic concepts of ecological and green design requirements interiors will have a great contribution the concept of sustainability. Interior finishing material selections and the interior surface applications like green walls can make a great contribution to the interiors, occupants and the sustainability as well (Fig:1, Fig:2).

Fig: 1: Ecological Interior

Fig: 2: Ecological and Green Interior

One of the important role in the construction of buildings is played by the choice of materials based on criteria that should meet several requirements. These must ensure throughout the life cycle duration of the building the reduction of the harmful effects on the surrounding environment. In this sense, a number of factors for the evaluation of building materials should be considered the life cycle of materials is the energy consumed in technological processes and transport. The exhaustion of natural resources, the impact of topographic changes on the environment due to extraction processes and waste resulting from the various life stages of the products, the pollutants emitted during some processes are factors that should be considered in the choice of the optimal building material for a construction with a well established use. Life Cycle Analysis (LCA) examines the global environmental impact of a material or product in each stage of its existence – from the obtaining of the raw material, manufacture, transport, operation, to demolition, evacuation or recycling [2]. Given the above, the following criteria for the evaluation of materials in terms of their ecological environmental impact are defined:

- criterion of resources;
- criterion of topographic change;
- criterion of waste and recycling;
- criterion of pollution;
- energy criterion;
- biological criterion (of interior environment) [9].

3.1. Interior Finishing Materials

Materials and design are always be very ecological and green interior spaces. The selection of material for certain product is of vital importance, while the material determines the use of our natural resources as well as the amount of energy used for the production and the use of the product [8].

Selection of material is traditionally made by technical demands like price, strength of material, temperature stability, density and hardness. The selection of material for certain product is of vital importance, while the material determines the use of our natural resources as well as the amount of energy used for the production and the use of the product. Selection of material is traditionally made by technical demands like price, strength of material, temperature stability, density and hardness [10].

Essential of the choice of building materials for ecological and green design starts from an analysis of the design theme regarding the use of the building, its expected life duration, the loads to which the building will be subjected and the thermal comfort requirements to be met, the choice of the building materials will have to take into...
consideration the following synthetic criteria
Fig:3[1].

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<td>Ecological</td>
<td>Embodied energy</td>
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<td>Percentage of waste reuse</td>
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<td>Percentage of waste reprocessing</td>
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<td>Percentage of use as earth filling</td>
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<td>Percentage of ultimate waste</td>
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<td>Fuel consumption during transport per t·km</td>
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<td>Thermal</td>
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<td>Factor of vapor permeability resistance</td>
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<td>Mechanical</td>
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Fig:3: Synthetic Criteria and Characteristics of interior Finishing Materials [1].

3.2. Interior Surface Treatments

Type 1 Wall System is the most versatile interior Green Wall system in the industry. In a standard installation, it is 100% water efficient, an industry first! Furthermore, it is completely self-contained, meaning no water will spill out the front onto the leaves of the plants and in front of the wall, this is the only system in the industry that has this capability. By using industry standard pots, it is easily maintained and can have plants easily changed out for different seasons and special occasions. It can be installed on virtually any indoor surface, and is designed to resist earthquakes. The main components of the system are [12]: Trays: patent-pending recycled polypropylene trays that can fit any wall dimension, waterproof Backing: tongue and groove waterproof backing along the entire back surface of the wall. Plants: accepts industry standard pots, plants do need to be removed from their pots, they just pop into the wall as is. Remote Irrigation System: computerized vertical ebb n’ flow irrigation system that allows for 24/7 remote control, when installed with our standard recirculation tanks, the system is 100% water efficient, all water is used by the plants. Recirculation Tanks: stored below or behind the wall (in an adjacent room), these tanks can be topped up automatically when a water supply is available, or filled by hand [11,12,13] (Fig 4).

![Type 1 Wall System](image)

Type 2 Wall System is made up of a floating stainless steel planter (vine container) system that safely trains vines over a building facade. Vine Containers are a great way to achieve the lasting, beautiful coverage an ivy wall can provide, without risking damage to a building’s facade and having to wait. Our system can provide wall coverage with vines in 1/10 the time of traditional vine trellis systems. The main components of the system are [11,12,13]: Containers: standard sizes are 3’W x 5’H, but can be customized to fit any design or size. Insulated container: an insulated container that can be heat-wire traced, ensures that your root ball doesn’t die from freezing shock in the fall and spring. Maintenance: designed for maintenance, the containers can either be mounted directly to a wall or on a maintenance catwalk (shown here) in very high installation situations. Remote Monitored Irrigation / Fertilization System: computerized vertical drip irrigation system with temperature sensors that allow for 24/7 remote monitoring- high efficiency since water is used only when needed. Wall Mounting System: designed to be mounted on concrete, wood frame, steel beam, or on a catwalk system in very high situations [11,12,13] (Fig. 5).
Type 3 Wall is specified for indoor environments such as lobbies, reception areas, hallways and other places of high traffic. Built for quick and simple deployment, the Wall system is naturally beautiful, eco-friendly, durable, easy to maintain and remarkably economical. It includes: Fully integrated design – allows for placement anywhere, no need for a water connection. Irrigation tank and pump – water tank, pump and timer are integrated into the base of the system, can be filled by hand. Non-spilling – no water ever falls forward of the system. Designability – a wide variety of plants can be used in the wall [11,12,13] (Fig. 6).

Type 4 Wall System is the most sustainable, comprehensive and widely-used system in the industry. The flexible, modular system can be installed on virtually any outdoor surface in any hot or cold climate, and is designed to resist heavy winds, wind-driven rain and earthquakes [11,12,13]. Panels: patent-pending 1 meter square stainless steel panels can be customized to fit any design or wall type. Non-Soil Structural Growth Medium: patent-pending growth material is non-erosing to ensure plant longevity, and much lower maintenance than loose soil systems. Plants: grown into the panels for several months before shipped to the site so that they will not blow away under strong winds or shake out of the panels under seismic activity. Remote Irrigation/Fertilization System: computerized vertical drip irrigation system with temperature and moisture sensors that allow for 24/7 remote monitoring - high efficiency since water is used only when needed. Stainless Steel Frame Wall Mounting System: can be mounted on concrete, wood frame, steel beam, and more, and allows panel removal for inspection as needed [11,12,13] (Fig. 7).

4 Conclusion
Contemporary economic and socio-cultural framework is required: a transition from a traditional material and product paradigm to an emerging knowledge and service paradigm; a transition in which the research into sustainability shifts from a technological and product-related innovation process to a broader techno-socio-cultural process. As well as ecological green and sustainable approaches in all fields. Interior architecture and interior design in the field of construction sector mainly should be developing
some ecological green and sustainable approaches in their design field. In the concept of ecological and green design in built environments, interior spaces have a great significance as they are the main shelters of the individuals. Using the basic concepts of ecological and green design requirements interiors will have a great contribution the concept of sustainability. Interior finishing material selections and the interior surface applications like green walls can make a great contribution to the interiors, occupants and the sustainability as well.

With this study the ecological and green design concepts within the built environment discipline was evaluated. Ecological and green design approaches in interior spaces were discussed and the main contributions of the area with interior finishing materials and the surface treatment systems were overviewed in order to make a contribution to the interior design field from ecological and green design point.

References: