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AN OVERVIEW OF GREEN WALL SYSTEMS: ITS PERFORMANCE AND BENEFITS IN SUSTAINABLE DESIGN

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ABSTRACT

In order to serve its aesthetic function, people have added greenery to their homes from a very long time. The new innovations used in these systems, however, have now incorporated the plant's functional advantages into this building efficiency and are seen as part of a green urban transformation and renovation strategy. In order to identify and systemize the different technology and characteristics of these green wall systems, the main purpose of this study is to investigate the variety of green wall system types. The study main objective is to explore the system requirements and construction method of these green wall systems in a sustainable environment modelling its advantages, performance and quality, in order to achieve sustainability in architecture. The outcome of the study would enable designers to choose suitable walling systems for their type of buildings, taking into account climatic constraints and environmental impacts, as well as the effect of their cost and life cycle, in line with sustainable strategies to achieve long-term efficiency.

Keywords: Green walls, Green roofs, Green wall systems, composition system, sustainability.

INTRODUCTION

Building facades using green technologies, such as green walls, are also used. However, by incorporating existing technologies into the execution of such systems, the functional utility of the plant can be optimized (Auld, H 2003). Often as part of a sustainability approach, greening systems are a part of the process of ensuring thermal comfort. Green systems contribute to the use of plants in the urban context without occupying land on the street level. Therefore, integrated urban design considers the reduction of the island's heat effect in the urban context (Lee, 2006). In fact, covering any building with vegetation will enhance the urban ecosystem and urban ecology, storm water control, air quality, temperature mitigation, thus cooling the urban

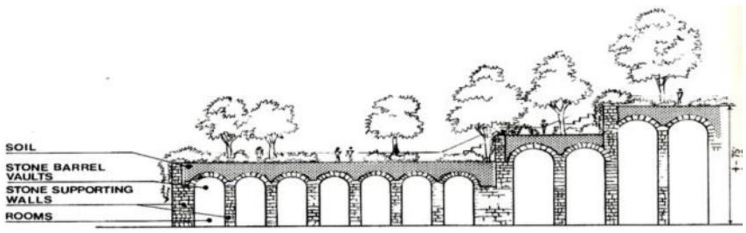


Figure 1: The section of Hanging Garden of Babylon, circa 500 B.C through Robert Koldewey's description.

heat island. The implementation of greener technology would also have socio-economic consequences. The aim of these systems is to promote growth of urban areas through healing process by promoting well-being of the members by providing a therapeutic environment with landscape or vegetation, enhancing the image of the city, as well as providing functional benefits by regulating heat gain (Dunnett, 2006).Green walls can also be referred to as a vegetated wall surface. The use of green walls was used by the Hanging Gardens of Babylon (Fig-1) and by the Romans and Greeks (Philippi, 2006). Vines were typically used to cover the pergola or shade building features in the Mediterranean climate. Throughout the 17th and 18th centuries, these plants were used as a building cover in the UK and central Europe. During the 19th century, they were used in building envelopes of European and North American cities. We have mainly investigated green facades' botanical aspects since the 1980s (Dunnett, 2008). The “Garden City Movement” inspired urban planning of the 19th century. The current idea of a garden within a house is a product of the Art Nouveau movement. While this occurred, new incentive schemes were launched to install this first. A significant amount of space was cut out of Berlin in 1983-1997 for greenery (Coffman, R & Martin, J 2004).

The aim of the paper is to examine the most significant green wall systems available, classifying the most significant existing green wall systems across the globe. The study of the green walls' solutions offers a representative collection of wall composition and material. The paper is divided into two major parts. The paper classifies green walls, explains their features, and includes a description of the various systems. Secondly, the green walling schemes have been systematized by the composition, installation and maintenance methods and their environmental impacts. There are two subsections added: A comparison of green roofs with conventional roofing, including variations in construction and maintenance, and the environmental efficiency of these green wall systems and factors influencing the efficient application of Green wall technology in building systems. The outcome of the paper shall enable the designers to select the appropriate type of Greening wall system suitable to their context to address the major challenges of environmental sustainability.

1. DEFINITION OF GREEN WALLS

Identification and classification of green walls schemes is based on construction methods and maintenance characteristics. Several researchers use various terms to refer to the green wall. The term vertical greening is used, while vertical gardening is used. Indirect greening and direct greening were used by Ottelé et al. and Perini et al. (Ottelé, 2011). Another concept to incorporate green walls to enhance the interior environment is known as bio walls. Both the living wall device and Internet of Things technology are included in this category. The theory of green walls can be summarized as the collection of plant species on or up within a vertical surface, such as a facade, partition wall, etc. There is a clear difference between the green facade of the Climbing Plants and the wall covering it with material and technology to support the various plant species that can be grown uniformly along the soil medium (Francis et.al, 2011).

2. GREEN FACADES IN WALLING SYSTEMS

The two applications (climbing and hanging) provide the basis for a green facade. Plants are directed at an upward surface or taper in direction as they grow up or into a vertical surface for hanging. Facades can be classified as indirect and direct. To create a clear green facade, plant species are directly attached to the wall (Fig-2). To create an indirect green facade, plants are supported by a structure. Self-clinging green facades are also regarded as a direct green card scheme that cling directly to the ground. Solutions for these green facades usually include the vertical support structure of the structural component for the growth of the plants. On the roof or inside the house the plants are often placed on top of the support structure and protected by it. Indirect greening systems may include modular solutions which use single integrated supports while also providing modularity via multiple trails which cover the surface. The main difference between these module plant trailers and the support system for plant growth on the facade.

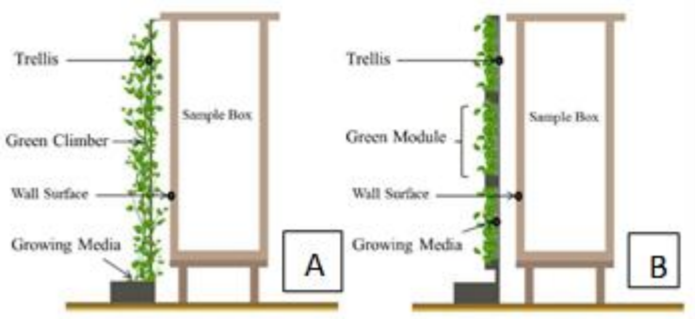


Figure 2: : Direct (A) and Indirect (B) Green Wall System

Living Walls:

Living walls are made of pre-vegetated vertical modules or plants that are attached vertically to a structure (Fig-3). These panels may be made of wood, plastic, stone, artificial stone, ceramic tile, metal, iron, reinforced cement or bricks, porous pavement, or just plain mud. Since plants can be so diverse and thick, living walls need more extensive maintenance than green facades. There are different types of living walls, including interior and exterior styles.

Figure 3: Living Walls

1. **Modular Living Wall:** A modular living wall framework emerged as a result of using modular green roof technology. Modular systems consist of a square or rectangular frame that holds growing media. The specific growing medium can be customized to suit selected plants and other design objectives. The nutrient requirements can be found in the modules within the growing medium. Water is supplied to the plant at various amounts in a gravity-flow system. Green modular systems are also pre-grown, producing an instant ‘green' look. Specifications may be from 12 and 18 months before initial availability.
2. **Vegetated Mat Wall:** The ‘Mur Vegetal' is a green wall designed by Patrick Blanc. It is made of two layers of fabric with pockets that support plants and growing media. The walls are protected by a frame and are backed by a waterproof membrane, because the wall is very moist. Nutrients are dispersed by an irrigation system that cycles water down from the surface (Fig-4).

Figure 4: Vegetated Mat Wall

3. **Bio filtration:** The aim of an active living wall is to filter the indoor air and provide thermal power. A hydroponically developing system is supplied by a nutrient rich water that is vaped from a gutter that is contained in the bottom of the wall system. A sheet of synthetic cotton and a density of up to three feet of dirt surround the roots (Fig-5). Through emitting these gaseous compounds, vegetation consumes the carbon monoxide and dioxide of these released VOCs. Cooler air flows into the system the through trees and is then spread around the building through the ventilation system. It is also possible for an array of green facade systems to be integrated, including the "green facade" combined with an advanced conventional system.

Figure 5: Bio Filtered Wall

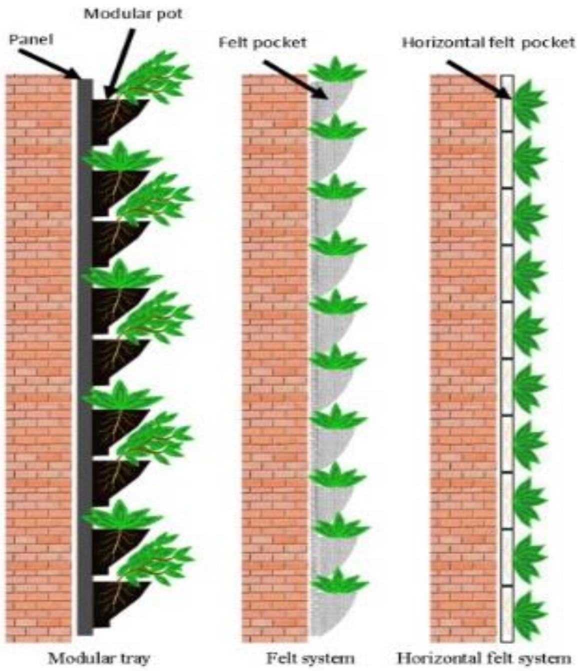
3. SYSTEM REQUIREMENTS

The approach to green wall technology primarily focuses on the design of systems and their structural components (supporting materials, growing media, vegetation, wastewater and irrigation) to ensure more efficient solutions and better performance at all stages of construction (installation, maintenance and repair). In the development of green walls, alternative building types (e.g. industrial spaces, high-rise buildings), building styles (new or existing building walls) and surface types (e.g. sloping surfaces, indoor partition walls and freestanding structures) are also of consideration.

I. SUPPORTING ELEMENTS

Typically, buildings with green façades do not have a significant support structure. Once in the cliff, they depend entirely on the ability of the climbing plants to attach themselves to the cliff. However, the production of order to gain more understanding may become too heavy when the vegetation reaches its maximum coverage and the possibility of falling increases. Green facades are said to serve as "double skin facades" that contribute to the building of an air gap between the surface of the building and the plants. Placing the support structure around the tree helps to keep the tree from collapsing. These modular or continuous structures are attached to the root system of the plant, keeping the plants steady so that they have more strength to tolerate weathering and competition (e.g., wind, precipitation, snow). As most green facades are supported by a structure of attached cables or ropes, copper is the most common material for supporting green facades. We can use steel frames and steel wires to hold the climbing plants and get them to bear the weight of the rising faster plants. Grids and wires provide the farmer with a limited period of time to cultivate plants and to preserve the soil's resources.

Green facade buildings also have pots filled with soil deposited within each of them, as well as support structures located at various heights along the exterior walls as well as a table in the centre containing soil, allowing components to be situated at different heights along the outer walls. Living walls need a structure to support the elements and the system allows plants to be mounted on it. The Continuous LWS (Living Wall System) is based on the installation of an electronic system that avoids space between the device and the floor or wall, and for this type of LWS, the electronic device should be wall-



mounted (Fig-6). Aside from the frame (bottom panel), the bottom is protected by the insulation formed by the frame. And it helps protect the layers close to it as well. It has layers [coated with layers] fastened to the bottom that allow it to be flexible, permeable and root-proof. The outside panel layer is mapped, and then a tiny pocket in the cut-out is for the positioning of plants. Modular hardware for wearables can take several forms; specially built hardware for wearables (e.g., trays, containers, planter tiles or flexible bags). Modular trays are usually made up of several interlocked parts, made of lightweight materials such as plastic (e.g. polyethylene or polypropylene) or sheets of metal (e.g. aluminium, galvanized or stainless steel). Each module typically requires an interlocking mechanism on the side of the package to communicate with another module to ensure system reliability. These modular parts can also include a front covering that forms a grid to protect the plants from the effects of falling. Standard trays and vessels are usually fixed to a surface-mounted vertical and/or horizontal foundation as a standard. In the frame profile attached to the vertical side, the back layer can also include mounting brackets that can be mounted to hooks or any other mounting means. Modular vessels provide for the mounting of similar-looking plants together in a line, in the same component (Fig-7).

Given their function, these buildings are usually made from polymeric materials and they become a major impact on the building surface due to their shape. To keep the plants light and not get too heavy, one can typically fill the LWS with a growing medium, which is quickly able to respire, a porous medium, where plants will rapidly expand, composed of organic and inorganic compounds or a covering of inorganic sub-strata, generally foam. The principal materials used in modular LWS are various receptacles of rising media. Built from a mixture of the light substrate with the traditional nutritive elements, the risen media are necessary to lengthen the life and strength of the container and to grow more seeds, it will increase the storage quality of the plants (e.g., combination of organic and inorganic fertilizers, nutrients and hormones for plants or other additions). The author indicates that one way to avoid its detachment is, by integrating rising media (like aluminium hydroxide) into the mesh bag that houses soil. This module could carry several bags and position them around the growing media. This could allow for more plants to be packed into the module. This could also be used to up the growing media of each particular plant in the module.

II. GROWING MEDIA

Figure 7 : Modular Vessels as growing medium

With regard to green façades, only modular system needs the choice of growing media which must be lightweight, with each component suspended and adjusted to the plant species and climatic conditions selected. Continuous LWS also do not have substrates in the area of living walls. These systems use lightweight absorbent screens where plants are placed in pockets, as mentioned before. Continuous LWS are usually based on a hydroponic system involving, a constant supply of nutrients and water, due to the lack of substrate (Fig-8).

The lack of soil is substituted by the supply of the requisite nutrients, for the growth of plants by irrigating water.

In order to reduce its weight, modular LWS are normally filled with a rising medium where roots can proliferate, made from organic and inorganic compounds or have a coating of inorganic substrate, usually foam. In order to achieve a good water retention ability, most modular LWS contain growing media based on a combination of light substrate with a granular substance, expanded or porous (e.g. mineral granules with moderate to fine particles, coconut fibres or recycled fabric), The substrate may have enhanced nutrients for plant growth (e.g., combination of organic and inorganic fertilizers, nutrients and hormones for plants or other additions) (e.g., combination of organic and inorganic fertilizers, nutrients and hormones for plants or other additions). The incorporation of rising media into geotextile bags to prevent its detachment is suggested by some modular LWS. These bags could span the entire module and enable several plants to be added or individually cover the growing media of every plant. Additionally, each plant should have a separate front cover to prevent the growing media from falling.

Figure 8: Hydroponic system in LWS

III. VEGETATION

The appropriate vegetation for the green wall depends on the environmental conditions of the building, the characteristics of the building, and the surrounding conditions in which it is situated. There have been several issues with plants' durability, even felt by the studied processes. Climbing plants are considered an environmentally friendly vertical greening choice. Two main types of foliage, evergreen or deciduous, are the plant species on the list below (Fig-9). Evergreen trees will begin to grow even throughout the fall. During this time the deciduous plants will gradually go through extreme leaf loss and give the forest a frozen appearance. Plants can be positioned around the face of a wall (e.g., root climbers and adhesive suckers) to their own support, or can be put upon a structure that protects them (e.g., twining vines, leaf-stem climbers, leaf climbers and scrambling plants). Efficiently sued as plaster, they have also previously been used to coat the exterior walls of small buildings in Germany and France. The traditional vines most particularly built-in pergolas in the warm summers to protect the facades. There is also a problem with climbing plants, which is an increase in limitations on their growth. Some species can reach more than 5 or 6 m, even others can be more than 25 m in height, but often require more than 3-5 years to mature.

A study in the Mediterranean Continental climate showed that after one yeargrowth of many climbing plants and perennials (Hereda helix, Lonicera japonica) and deciduous plants (Parthenocissusquinquefolia, Clematis sp) the foliage density achieved was insufficient to cover their bases Parthenocissusquinquefolia (Virginia Creeper), also known as dwarf privet, Privet lanuginosa, or Chinese privet, will effectively cover the whole ground surface in the long term, but none of the species selected were able to cover the full ground surface after a year. Some plants often have a rough time adapting to this climactic conditions, with strong year-round temperature variations and poor rainfall, such as Clematis, which has been affected by summer conditions. Living wall structures inspire new aesthetic concepts behind green walls that occur now, and share possibilities for plant species outside of nature, based on creative strategies involving plant species, the inclusion of patterns, changes in color, a variety of form, forms, and density of vegetation, and efficiency of growth. This technique also provided for green walls to be applied to a wide variety of plant varieties, allowing shrubs, grasses and perennials to be introduced into the project as long as their drainage and nutrient needs are taken into account. Hydroponics requires only a wide variety of plants to grow, totally indifferent conditions of growth: the plants are grown, the cuttings are cut, or the seeds are planted. In such instances, according to the intended visual style (like "Lord of the Rings")., trees are selected. This involves sufficient watering and nutrients for proper growth. It is therefore necessary to assess the growth, colour, flowering, foliage and general plant composition of plants according to the artistic purposes of a certain building (e.g., building structure in the urban context, advertisement of a specific company, or contrasting of a building or interiors).

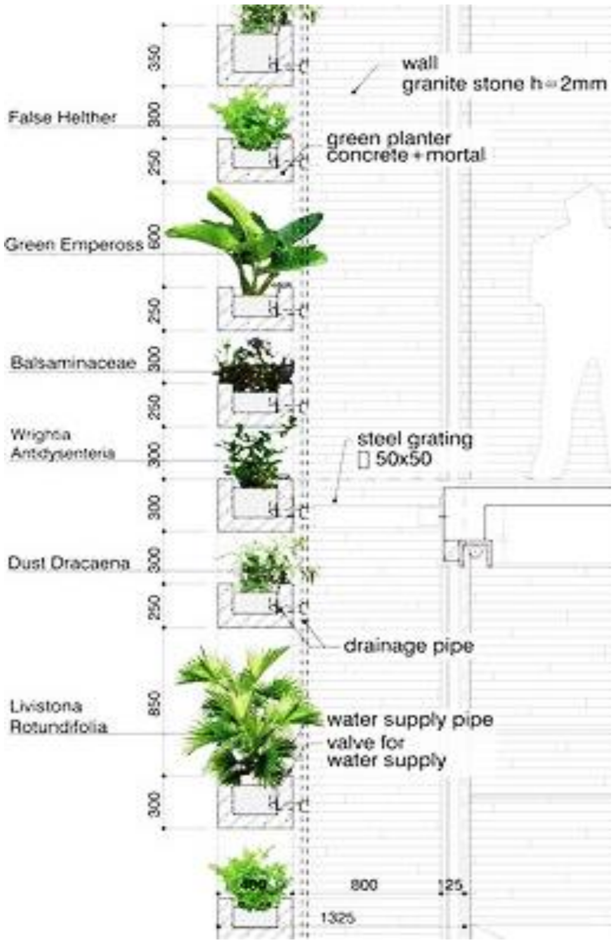
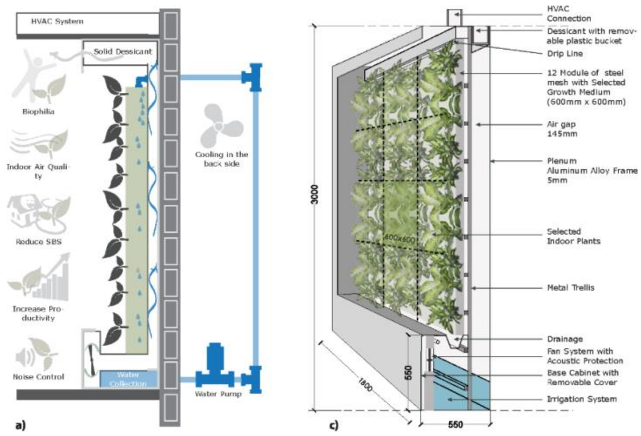


Figure 9: Types of Vegetation in LWS

Plants on the other hand should have low irrigation needs (exam lesson outline, for example, learn accurate salinity levels for various varieties of turf grass). Adapt to local environmental conditions (exam practice outlines teach when to drink, and when to not) (e.g., wind, precipitation, temperature, drought and frost).The LWS addressed at the meeting included a new modular option for greenhouse walls that work by incorporating a landscape of succulent sheets into the frame. The use of drought resistant plants as succulents reduces the amount of water the plant uses. Urban brownfield sites also have low maintenance demands, eliminating the requirement for the structure to have an incredibly heavy structure. Although carpets for hills, carpets can to be painted blades or trees, they even to attain a flat vegetated surface is very wonderful. The use of perennials and shrubs on larger surfaces enables the growth of more ornamented Green walls have unique potential for urban farming, particularly in cities where there is a lack of land for agriculture, reducing the impact of food production systems on the climate. The plants living in such areas have such a diversity of colours and shapes that make them appear weathered. Japanese studies have also shown a methodology for using plant species that can be used on sloping surfaces. The integration of vegetables and aromatic herbs into green walls, green partitions and green vaults are considered to be modern concepts in green walls, green partitions and green vaults, as planters and containers strengthen the functional potential of the wall, the partition or the vault.

IV. DRAINAGE



V. Figure 10: Drainage system in LWS

In the green walls, the excess of fluid runoff happens by gravity. Geotextiles are utilized through retrofit LWS systems that allow proven by avoiding of roots and that enables lighting of a permeable membrane with a permeable membrane used as a substrate with the conveyance of water inlets and out outlets that can be pooled and reused for modules at the floor, as well as the vertical gaps with the modular trays so as to pool the water accessible and ready to offer drainage. Often the lower portion of a modular can be either concave, bent, pierced or manufactured in a porous or absorption material for a better drainage system. Examples involve containers (i.e., fermentation tanks), which suggest a use of a substance such as cellulose or polyacrylonitrile (PAN) or glass (e.g., inoculation of sand or any form of material as a barrier to absorb rain water, heavy metals and pollutants) or a granular inert filler (e.g., expanded slate, expanded clay, gravel) promoting the drainage of roots and the development of plants (Fig-10). Consistent with other modular system designs, the inclusion of grooves or holes on certain sides and rear of modules for improved air ventilation and eliminating the extra humidity of the air is often mentioned in many cases of modular system

VI. IRRIGATION

The parameters differ based on the type of device, the plants, and temperature. To help plant growth, modular green facades and landscaping require an irrigation system. Nutrients, fertilizers, nutrients, phosphates, amino acids or hydroponic elements can be applied to water to boost the growth and vigour of plants. A consistent irrigation tube mounted at the top produces the LWS water flow. The continuous LWS irrigates using a watering system.Central device mounted at the top of the building. The pore size allows consistent water and nutrient delivery in the case of a continuous LWS.A recess in the upper surface of the module. The irrigation tubing requires a modular package of LWS. For irrigating the growing media by gravity, holes are in the recess. These drain holes are used to allow excess water to irrigate the modules beneath. Irrigation tubing can be made in a range of materials (e.g. rubber, plastics, thermoplastic tubes, silicone and irrigation tubes). Using irrigation systems that provide regulated delivery and strength to the needs of the plants. A filtration system may also be mounted to avoid clogging. Any LWS recommend strategies to limit treated water use. Strategies such as reducing water use by the reuse of water from rooftops, the use of water from the wastewater system and the installation of sensors that control the water tank, the volume of water supplied and environmental conditions. Modular or continuous LW systems also have a drain, or an excess water tank, to repair and reinstate watering system as needed. Devices are being built that sense the levels of the nutrients that are required. This will help minimize the intake of nutrients and fulfil plant requirements.

VII. INSTALLATION AND MAINTENANCE

In the long-run, green building facades with plants nearby are more cost effective but are subject to some constraints on plant variety, such as plant height and scale. Since plants are frequently transferred from one area to another, keeping a constant degree of relative humidity for all vegetation is challenging. Lacking in expertise, many planting seedlings and plants still require a leading hand to ensure a proper coverage area. It is also important to remember that certain species of climbing plants can damage the surface of buildings, destroy buildings with their roots in cracks and carry cracks. On a modular trellises, a new station could do something different, instead of the same station working the entire time. Plants that are grown at a range of heights also helps mitigate the impact of a dispersed growth of climbing plants on the surface and encourages poor plants to be replaced. In the market, there are a limited amount of modular LWS that are being used to minimize problems of installation, maintenance, and repair. Such modular systems allow for each of the individual components to be disassembled for repairs, and, on some, there is a movable cover (the front) that allows for maintenance of the walling material, or the installation of plants or other features. In order to be able to handle the transportation and the manufacturing processes, these modular pieces can also be nested into one another. the architecture basis as opposed to the traditional modular structure, the continuous LWS is best suited for the creation of different vegetated surfaces. Many plants on earth live in a comparatively low density climate with an average of thirty plant species per square meter and a density below thirty kg/m2. Planting systems that use continuous irrigation are usually hydroponic systems and they need a more permanent water source to provide a normal outcome, which results in a higher cost due to more upkeep and respect to water use. It's also necessary, though, to remember that any green wall system would have its own needs, based on its aesthetic capacity, cost and maintenance requirements, with benefits and disadvantages. The option of the most appropriate design method is often closely related to the locations of the building features (e.g. access-level, height) and environmental requirements (e.g., exposure to sun, shading and wind, precipitation). Therefore, it is important to pay careful attention to the structural variations and main characteristics of these samples.

4. ENVIRONMENTAL PERFORMANCE OF GREEN WALLS

Numerous experiments have been undertaken by scholars to evaluate the environmental efficiency of different green wall systems over their entire lifetime, in order to properly explain whether green wall systems can be considered sustainable. Direct green facades are a more sustainable and economical solution. In view of the lack of materials used and the low maintenance requirements, these structures have negligible environmental effects. Their durability may be questioned when determining the life-cycle of certain LWS. Variations in the type of products used, their longevity, their recycling ability, plant lifespan and water use can have a direct effect on the overall environmental impact. According to Ottelé et al., the incorporation of stainless steel as a support system could have an effect 10 times greater than the use of other recyclable products (e.g. HDPE, FSC certified hardwood or coated steel). The consistency of products is another important problem. Many objects, such as PVC and others, are of little lifespan and need to be replaced more than once during the life of buildings. However, green wall solutions often use materials that have a major environmental impact. Latest experiments have shown that certain systems can reduce the environmental burden by applying thermal resistance to the wall, leading to a reduction in heating and cooling energy usage. The cost of green wall systems may also be a vector with a significant influence on the selection process. Compared to direct and indirect green facades, LWS is costlier. Based on the devices used, the modular green facades have varying prices, such as the galvanized steel system, which could be 4-8 times costlier than the HDPE framework. In the case of LWS, the costs also rely strongly on the materials used and the design of the unit, with a cost of EUR 1200/m2. The costs are often dependent on the application process (taking into account the surface dimension and ease of access) and the criteria for repair work (e.g., irrigation, nutrients, plants replacement). Improving the performance evaluation of recent green wall systems will, however, lead to an improvement in their installation in buildings and, as a result, to a price reduction. Importantly, the decision to make the green wall scheme more suitable for a given project should be based not only on the architecture and climate limitations, but rather on the environmental effect of the components (e.g. the energy or services required and the recyclability of materials) and associated costs during its life cycle.

A green wall provides the public and private sectors alike with great advantages. Green walls are a great investment in environmentalism and urban growth given the wide surface area available. In areas where roads and parking lots have a lot of vegetation, air pollution is minimized. Plants in a garden act as a great filter for toxins and can consume a great deal of toxins in the air. The benefits of a green wall in regards to energy efficiency are awarded to the design variables that include the leaf area, leaf density, site conditions, and size of the project. Some of the green walls benefits are shared by almost all green walls, so they would meet the same design/client goals as any other green wall. Some of their benefits are hard to design and acquire in any other way than they are built. Small projects to construct individual private spaces, and big projects like buildings will create a wall of vegetation. Green walls are incorporated into the architecture of structures, systems and multiple forms. The major impacts of green walls with respect to the area of impact is illustrated in the following table. (Table-1).

Table-1: Environmental benefits of Green Walls

Serial no.	Area of impact	Benefits
1	Noise Reduction	The growing media of modern plants in a living wall system will lead to a reduced sound level that a wall could reflect or transmit from the living wall system. There are many factors that affect the noise reduction of living walls, such as the depth of the increasing media, the "constructively smart" integrated architecture, and the widespread pattern of structural layers.
2	Improved Indoor Air Quality	The airborne contaminants, including dust and pollen. The noxious gases and VOC's from carpets, furniture and other building components.
3	Improved Energy Efficiency	Seals up a thin layer of air within the plant mass. The heat would be a restriction, particularly of thick green vegetation. Sunlight is decreased by shading and through the plant processes of evapotranspiration. May be used to create a preventative against heavy winds during cold seasons. The interior applications that use the outside air for heating and cooling purposes can save on energy costs.
4	Building Structure Protection	It protects exteriors from UV radiation, the elements, and temperature variations that wear down materials. Studies say damage from wind can be minimized by applying a material to seal or air tightness to the entrance of doors, windows, cladding, etc.
5	Aesthetic Improvement	Augments the visual perception. Adjusted to conceal some unsightly features. Increases the land value. It will have interesting freestanding structural features, etc.
6	Reduce Urban Heat Island Effect	It can reduce environmental heating. Cools down the ambient temperatures in the city. With the advent of vertical air flow slows down, thus cooling the air.
7	Improved Exterior Air	It absorbs airborne toxins and material that is collected on plant leaves. Pollutants are filtered out for us to breathe.

	Quality	

5. COMPARISON OF BENEFITS BETWEEN A GREEN ROOF AND A CONVENTIONAL ROOF

Urban green space performs ecological roles in the built environment, softening the visual lines of the city, and promoting biodiversity. Green roofs are usually populated by numerous insects, ants, spiders, and have been used by nesting birds. Studies have shown that "green roofs" and other gardens really help preserve rainforest and helps stabilize rainwater. Although so a brand new technology, it is applied in miniature-scale but it serves and involves wide section of society. The following Table-2 includes details comparing the beneficial benefits of a green roofing systems to a conventional roof system with the basic formwork is courtesy (Peck, 2008, Anjali Gupta, 2018).

Serial No.	Beneficial aspects	Green Roof	Convention roof
1	Energy Conservation	Insulate roofs of any buildings.	Mostly one can achieve a light coloured roof and reduced energy usage by adding insulation to a home, or by painting the roof white.
2	Air Quality	Shading and the evapotranspiration of water rises.	None
3	Mitigation of Urban Heat Island	Prevents temperature increases	Combined with the light coloured roof, for instance. white tiled roofs.
4	Improved water quality	It preserves its atmospheric deposition and retards roof material deterioration. Reduced volume reduce	None

		pollutant loadings	
5	Temperature	In hot season mitigation	Achieved through insulation
6	Storm water volume retention	At 10-35 percent during the rainy season, and at 65-100 percent during the dry season.	None
7	Vegetation	Allows seasonal evapotranspiration; photosynthesis.	None
8	Habitat for Species	For bird and insects	None
9	Cost offsets	Reduced storm water facilities, electricity savings, higher rents, improved property values; all these help us and the public gain as we save energy and lower usage.	None
10	Durability	Inside a protective water-vapour barrier, a practical and robust waterproof membrane can last 36 years until it needs to be properly sustained.	Almost zero security and low exposure to means that roofs could only last for approximately 20 years.

Table-2: Comparison of benefits between Green roofs and Conventional Roofs

6. FACTORS FOR ACHIEVING SUCCESSFUL GREEN FACADES

Design, construction and maintenance requirements for green facades and living walls will differ by device type chosen and the conditions of the constructed and natural environment. Architects, builders and building management must take the following into account: General building entry, fire safety, fire solutions, and electrical device efficiency.

1. The connection of the sides to the building or freestanding frame, which will act as a form of additional defence mechanism. Figuring out the structural loads in larger structures after factors such as snow, plants and wind are added in, is also critical.
2. Assess the amount and consistency of any particular plant to reduce the wind and light exposure. Architects need to take into account design decisions that elicit aesthetic considerations and site orientation, which will need to be decided by the developers.
3. To maintain the health of the living structures in the marine or aquatic-in-pedestrian systems, plant management and/or long term maintenance plan must be made by the system.
4. The organization should consult with suppliers who may have licensed or specially qualified engineers who may be able to conduct the project successfully. This would mean sufficient selection of plants for a particular area, the proper interval for spacing between plants for desired coverage, that the nursery (garden) needs to be demolished and set up, and then returned to the retailer where it is purchase.

CONCLUSION

One of the key challenges in the field of green walls is to find innovative ways to consider the benefits of water preservation materials, irrigation means and easier assembly and repair, as well as to demonstrate their potential for applications in the field. For building façades, the use of green walls has becoming a core component of sustainable architecture. In the years to come they will become very significant features in our communities. Green design developments, such as green walls, provide a broad variety of opportunities for designers who are interested with adding the building envelope to accomplish different aims and to construct innovative free standing architectural features on the interior and external surfaces of structures. Since companies who manufacture these devices have extensive knowledge of design as well as the production methods, it is essential if the project has a firm grasp on them so they can help direct the green wall through the creation process.

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