

## DEVELOPMENT OF SUSTAINABLE ARCHITECTURE IN CONSTRUCTION PROJECT

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### Abstract

With growing concern about the climatic changes and greenhouse gas emission, construction industry, as a major part of environmental impact. Now days we are realizing importance of sustainable design and its operation. A lot of research has been done on sustainability still use of conventional methods of construction being used on different sites.

In developing countries like India whose economy in the infrastructure and urban development is increasing very rapidly need of sustainable design to maintain energy consumption, waste produced, materials and other factors is important. International decade of 2014-2024 for sustainable design and energy to all is to promote its awareness to bind the world with it to reduce the climatic changes which will be effected by human beings.

This paper tells the importance of term sustainability, methodology used for sustainable design , study of energy consumption, cost, waste etc with conventional methods and promoting of sustainable development. The basic objective of publishing paper is to enhance global sustainability practices and to promote the research and innovations aimed at creating a sustainable healthy environment that reduces resources consumption, reduce environmental degradation and creates better environment for living

**Keywords** – *sustainability, sustainable architecture, energy, cost, environment, materials*

### 1. Defination

Sustainability does not have a standard definition, some major aspects of sustainability are as follows:-

- Sustainability is an attempt to merge of ecology and economy into one system.
- Sustainability means living a life of dignity in harmony with nature.
- A sustainable community is one that resembles a living system where all of the resources (human, natural and economic) are renewed and in balance for perpetuity.
- Sustainability means taking the long-term view of how our actions affect future generation and making sure we don't deplete or cause pollution at rates faster than the earth is able to renew them.
- Sustainability means living within the resources of planet without damaging the environment now or in the future

Sustainability means creating an economic s while renewing the environment and its resources.

(International Journal of science and technology vol-2 No-8 August 2013 by M.Sirija)

### 2. Sustainable Architecture - 2.1 Introduction

Sustainable architecture is a term that describes environmentally aware design techniques in the field of architecture also it seeks to minimize the negative environmental impact of the building by enhancing efficiency and moderation in use of materials, energy and development spaces. The idea or approach of sustainability ensure that the action or decision made today will not reduce opportunities of future generation.(International Journal of science and technology vol-2 No-8 August 2013 by M.Sirija)

Sustainable Architectural Building is the type of structures means different factors like design, materials, and use of energy, cost, and the environment, are considered together to creating a functional structure which meets the needs of the present without compromising the ability of future generations to meet their resources.( United Nations World Commission on Environment and Development, WCED, 1987). The structure said to be sustainable when it is energy efficient, producing less waste and it can be easily reused or disposed without affecting environment, materials used are free from eliminating less CO<sub>2</sub> (Sustainable urban areas ENHP 2007 by E Oberndorfer, J Lundholm, B Bass). Currently, most of the materials we use to build our homes are hazardous to our health, and the building process creates an enormous waste, which makes up a huge percentage of our landfills. (Planning design for affordable housing and green architecture by N.S.Mohamad and Z.S.Darus vol. 8 No 4 2011). By rethinking the design from the beginning, reusing building materials, and using sustainable materials which are greatly waste reduced, as well as increasing efficiency and the condition of our own health. (Sustainable architecture by sam C. M. Hui 1996) Architecture is a field of arts, science, philosophy and development and it consist surveying, planning, engineering, biology, and much more. Ecological and green design ideologies are significant titles that are directly related in within the concept of sustainability in the built environments.(Design parameters and initiatives for ecological and green design and architect by G. G. Anktas E-ISSN Vol-9 Iss -2 April 2013) The concept of sustainable design in the construction sector 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). A “green” or “sustainable” facility is a structure designed, built, renovated, or operated in an ecologically and resource- efficient manner (Green Design and Sustainability in sports and recreational facilities byF. Gibson from Issues in practice manuscript vol-4 Iss-2 2008 ).

The combination of building design and construction that examines all aspects of the building process that will effect and be affected by the environment.

It Consists of buildings designed, built, renovated, operated, or reused in an energy efficient and economic manner. (A planners guide to sustainable development by Kevin J. Krizek and Joe Power)

## 2.2 History of Sustainable Architecture

The origin of the green architecture movement stems back to the green political movements during the 1970's and 80's. Key events include the energy crisis of the 1970's, the formation of the Greenpeace organization in 1971, as well as conception of the Green Party in European and United States governments during the 70's and 80's.

In 1990s, sustainable development has emerged as the new standard of economic growth based on the carrying capacity of the earth. Consequently, the built environment – architecture and urbanism – have been amongst the core sectors of intervention to achieve sustainable development. (sustainability and architectural history survey vol-11 iss-1 2014)

The concept of sustainable development formed the basis of the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992

([http://www.sdcommission.org.uk/pages/history\\_sd.html](http://www.sdcommission.org.uk/pages/history_sd.html))

## 2.3 Need of Sustainable Architecture development

The modern day construction is largely based on the materials derived from the surroundings environment. Construction activities use the forms of energy and the natural resources on a large scale with the production of huge quantities of by-products. This is leading to the consumption of the resources of the earth on a much faster rate than the regeneration of these resources. Similarly the production of tonnes of by-products is introducing unwanted materials into the environment as a result, further polluting it and shortage of the natural resources etc.

All this highlights the very need of protecting the environment and preserving it for the future generations, points towards the high need of adopting a sustainable way of construction and architecture

(International Journal of science and technology vol-2 No-8 August 2013 by M.Sirija)

## 2.4 Advantages of Sustainable Architecture

- Lower electric and utility costs
- Environmentally effective use of building materials
- Enhanced health and productivity
- Long-term economic returns
- Reduced environmental impact

### 3. Methodologies of Sustainable Design

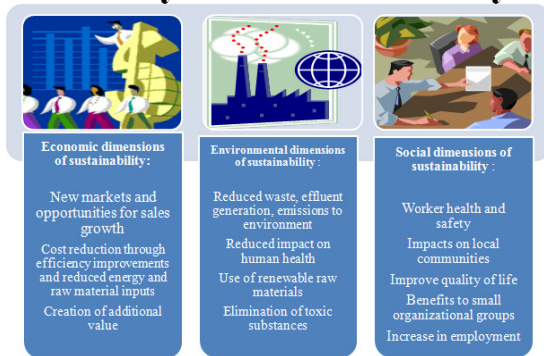
#### 3.1 3-D System of sustainability:

##### Three Dimensions



Fig-

#### 3-D System of Sustainability



**Economical sustainability-** It improves the market and sales of an organization prior to achieve sustainability also achieves cost efficiency through efficient use of energy and resources. (Design parameters and initiatives for ecological and green design and architect by G. G. Anktas E-ISSN Vol-9 Iss -2 April 2013)

**Environmental sustainability** – the main factor of sustainable design is to use of renewable source of energy, reducing environmental impact of material used, allowing less wastage of materials.

**Social sustainability** – social impact of design involves health and safety parameters of workers. Improvement in quality of people, increase in the employment etc all this dimensions are involved in sustainability.

#### 3.2 Process System of Sustainability:

##### Process System of Sustainability

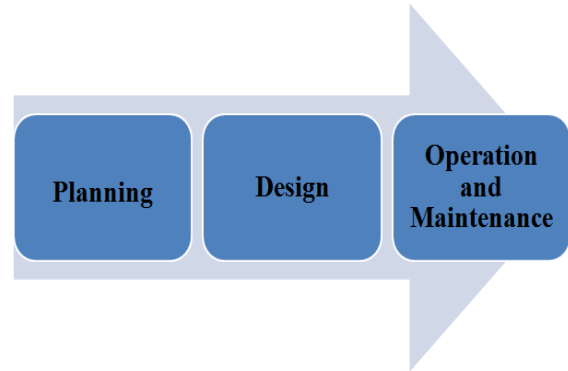


Fig-

##### Planning Process

1. Site selection and planning
2. Budget planning
3. Capital planning

##### Design Process

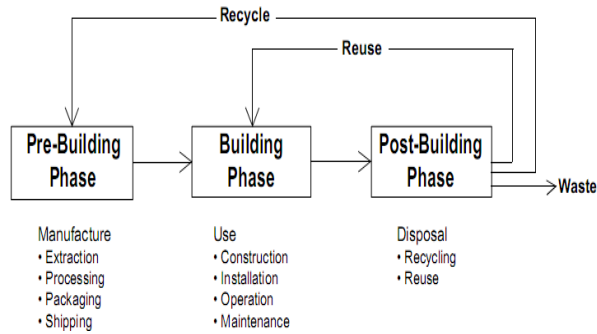
1. Client's requirement and project goals
2. Green vision & green design criteria
3. Well-integrated design
4. Performance goals

##### Operation & Maintenance

1. Commissioning of building systems
2. Team development
3. Resource management
4. Building operation
- 5 Maintenance practices
6. Renovation or Demolition.

(Planning design for affordable housing and green architecture by N.S.Mohamad and Z.S.Darus vol. 8 No 4 2011)

### 3.3 Three Phase System of Sustainability:



Fig

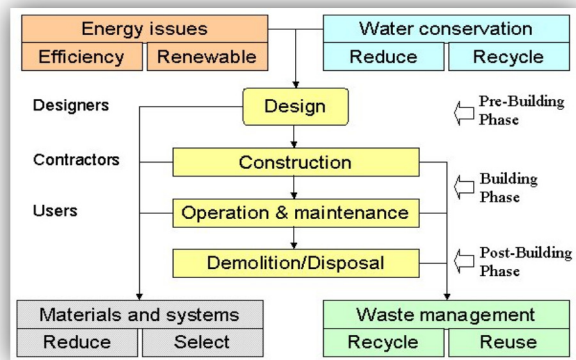


Fig-

#### Pre-Building Phase-

This phase has the most potential for causing environmental damage. As understanding the environmental impacts in the pre-building phase will guide planning of selection of building materials, its manufacturing and procurement and etc.

#### Building Phase-

This phase begins at the point of the material's assembly into a structure, includes the maintenance and repair of the material, and extends throughout the life of the material within or as part of the building.

#### Post-Building Phase-

This phase includes the maintenance and repairs of the structure requiring frequent maintenance with such chemicals, or requiring frequent replacements that perpetuate the exposure cycle.

(<http://www.greenbuilder.com/general/buildingsources.html>)

### 3.4 Sustainable Strategy Design:

In order to move towards sustainability, it is predicted that we will need to achieve between 'factor 4' and 'factor 10' levels of resource and energy reduction. This will require the development of significant breakthroughs in thinking and technology. (Journal of sustainable product design Iss-1 April 1997)

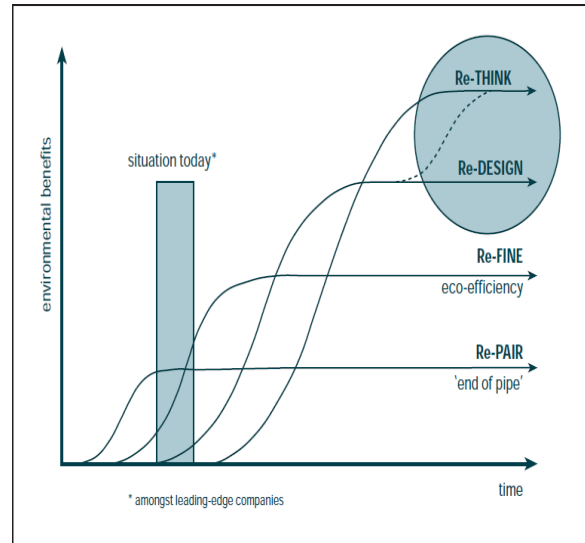


Fig-

At present, the majority of companies are still at the 'Re-pair' stage, dealing with end of solutions. However, some companies are moving towards progressing to 'Re-fine' existing processes and products through the implementation of the concept of eco-efficiency

Someone must have started progressing to 'Re-design' existing ideas to incorporate environmental factors – although the development process is still immaturity

To move beyond 'Re-design' to 'Re-think' will require significant leaps in thinking, driven by an emphasis on creative problem-solving and opportunity seeking. An essential element of this process will be the development of a more systemic infrastructure to enable the cyclical flow of resources.

## 4. SUSTAINABLE BUILDING

**METHODS :** (International Journal of science and technology vol-2 No-8 August 2013 by M.Sirija)

### 4.1 To minimize environmental impact-

A well-planned site will preserve much of the natural vegetation, increase the energy efficiency of the building, and reduce the amount of storm water leaving the site. In addition the amount of excavation required can be reduced, thus reducing construction costs and environmental impacts of the construction process.

The Site dimension integrates building research and architectural science and relates to factors associated with land use, land conservation or remediation, planning and development, ecological value of land, habitat preservation, water body preservation, vegetation and shading, desertification, heat island effect, air flow and acoustic conditions. It also covers aspects related to the well-being of a society including walk ability, bike ability, landscape amenities, and public spaces.(International journal of sustainable built environment by Elsevier B.V. 31 jan 2017)

**4.2 Heating, Ventilation and Cooling System Efficiency** – (International Journal of Science and Technology (IJST) – Volume 2 No. 8, August, 2013)

The most important and cost effective element of an efficient heating, ventilating, and air conditioning (HVAC) system is a well-insulated building. A more efficient building requires less heat generating or dissipating power.

Windows are placed to maximize the input of heat-creating light while minimizing the loss of heat through glass, a poor insulator.

Certain window types, such as double or triple glazed insulated windows with gas filled spaces and low emissivity (low-E) coatings, provide much better insulation than single-pane glass windows.

### 4.3 Use of building materials –

The Materials dimension relates to factors associated with sustainable materials including production of eco-materials, recycling technologies, disposal of materials, innovative products and recycled materials, responsible sourcing of materials, embodied energy and life cycle assessment (LCA). (International journal of sustainable built environment by Elsevier B.V. 31 Jan 2017)

### 4.4 Indoor Environment

The Indoor Environment dimension relates to factors associated with indoor environmental quality such as thermal comfort, air quality, acoustic quality, light quality, low-emitting materials, natural ventilation, mechanical ventilation, indoor chemical and pollutant source control, glare control, illumination levels, acoustic, and daylight. (International journal of sustainable built environment by Elsevier B.V. 31 Jan 2017)

### 4.5 Waste management

Provide recycling bins near kitchens and under sink compost receptacles.

Provide for convenient pickup locations for waste removal service.

Recycle water from sinks, showers, washing machines (gray water) for irrigation in some areas such as court yard gardens if current codes prevent gray water recycling, consider designing plumbing for easy future adaptation.

### 4.6 Passive Solar Design

When sunlight strikes a building, the building materials can reflect, transmit, or absorb the solar radiation. Passive solar design maximizes the amount of solar energy absorbed and uses it to heat and light buildings. It is important to stress the need for high quality insulation when planning a passive solar design. There are three main considerations in passive solar design: building orientation, overhangs and shading, and thermal mass. (International Journal of Science and Technology (IJST) – Volume 2 No. 8, August, 2013)

### 4.7 Green Roofs -

Green roofs are lightweight, engineered roofing systems that protect the integrity of the roof and provide many benefits for storm water management and energy efficiency. The “Storm water Management Systems” section describes green roofs and the benefits for storm water management. Below are additional benefits for energy efficiency. (International Journal of Science and Technology (IJST) – Volume 2 No. 8, August, 2013)

### 4.8 Sustainable Building Consulting

Sustainable building consulting is a practice or service where an intermediary party or company is utilized as a way to forecast levels of sustainability during conceptual architectural stages. This forecasting consists of the identification of adherent building techniques and norms, as well as the identification of specific building materials. (International Journal of Science and Technology (IJST) – Volume 2 No. 8, August, 2013)

## 5. Comparison between the designs;

| Issue                 | Conventional Design   | Sustainable Design   |
|-----------------------|---|--|
| Energy source         | Non renewable and destructive source                        | Renewable source   |
| Materials use         | Non-recycled  | Recycled   |
| Pollution             | High  | Low  |
| Ecology and economics | Short-run view  | Long-run view  |
| Design criteria       | Conventional, and convenient                                | Energy efficient   |
| Knowledge base        | Narrow focus  | Integrates multiple design   |
| Spatial scales        | Tends to work at one scale at a time.                       | Integrates design across multiple scales,                            |
| Types of learning     | The design does not teach us Views and culture of nature as | The design draws us closer to the systems that ultimately sustain us |

### 5.1 Barriers of sustainability –

Sustainable development is now widely promoted as a holistic concept that aims to integrate social, economic and cultural policies to ensure high-quality growth in the context to which it is applied. During implementation such programs encounter, however, place-specific institutional and cultural barriers that often go unrecognized.(The key drivers and barriers to sustainable development for commercial property by S Bond and G Perrett JOSRE Vol.4, No-1, 2012 )

#### Developing Administrative and Planning Capacities-

Successful implementation of many sustainable development programs has been notoriously complex. Arab countries are not alone in finding it difficult to adapt their economic and administrative systems to the rapid changes that many of the donor countries demand of them (Underhill, 2003). Bressers (2004: 285) points to the ‘outside-in’ nature of sustainable development programs. It requires considerable flexibility and motivation by the policy actors to infuse externally developed policies into an already existing policy apparatus

Many of these challenges could be overcome with effective planning, strategic investment in tourism infrastructure, and community involvement in site development. But not until the social, cultural, and environmental costs of tourism development are included in the decision-making calculus will there be true sustainable tourism development

#### Engaging Local Stakeholders

In the past decade, planning that enhances the overall economic benefits of development to local communities has been the focus of development efforts (WTO, 2002). This participatory development process contributes to sustainability because local communities are often best situated to determine the true costs social, cultural, and ecological – of development. Recently, the concept of ‘social capital’ has been interjected into the policy process. It emphasizes the untapped and underappreciated capacities of communities to facilitate the implementation of sustainable development. It encourages grassroots democratic processes based in social networks, generalized reciprocity and trust, collaboration, and local autonomy. From this perspective, communities play a vital role in the sustainable tourism development process (Pforr, 2004).

(Barriers to Sustainable Development By M Reid and W. Schwab in journal of Asian and African studies Vol. 4, 5/6, 2006)

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