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BUILDING CONSTRUCTION ACTIVITIES AND THE ENVIRONMENT: *TOWARDS ACHIEVING SUSTAINABLE DEVELOPMENT.*

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ABSTRACT

Buildings are a major consumer of natural resources, through both their construction and operation. In fact the construction activities account for an estimated 40% of natural resource consumption. This has resulted in pressure on the environment's finite natural resources, besides creating impacts on human health and well-being. Thus, a major challenge in the twenty-first century has been the need to consider human activities within an ecological framework—the sustainability issue. This paper discusses the prime environmental issues that have to be dealt with in totality in construction activities to ensure sustainable development. These include land degradation, biodiversity, air pollution, energy, and management of fresh water. It suggests ways that can steer the construction industry to design, develop and operate sustainable buildings.

KEYWORDS: building; construction; environment; pollution; sustainable.

1.0 INTRODUCTION

Construction activities in Nigeria, as in other developing countries, have been pursued without giving much attention on environmental issues; even though it is one of the largest activities driving the economy that has a significant impact on the environment. Unplanned and unsustainable urban development has lead to severe environmental pressures. In this present millennium of increasing urbanization where more than half of the world's population is living in cities and towns; there is pressure on the environment's finite natural resources, besides creating impacts on human health and well-being. The green cover and ground water resources have been severely depleted to give way to urban centres. Modern buildings in our cities have high levels of energy consumption because of requirements of air-conditioning and lighting.

The construction sector accounts for an estimated 40% of resource consumption (ECTP, 2005). The players in the sector (contractors, authorities, architects and other designers, purchasing bodies, and the full range of suppliers, clients and users) therefore, have a crucial role to play in achieving sustainability. Environmental issues that the sector faces on a daily basis include: reducing greenhouse gas, mitigating existing polluted areas, enhancing energy efficiency and conserving natural resources such as green field spaces, water, energy and balanced ecosystems. When it comes to the vital issue of energy, construction has an important role to play in reducing its use and finding alternative sources of generation.

The built environment can be seen as a synthesis of social, environmental and economic issues, reflecting immediate and long-term problems and opportunities. Since the design, construction and maintenance of buildings and infrastructure are essential for economic development and sustainable growth as well as for the quality of life of the people, the answers to many of the challenges facing the environment depend on the construction sector (Barford, 2002).

A large portion of the wealth of any nation is invested in its built environment: housing, infrastructure, industrial and commercial facilities. The quality of this built environment, expressed in terms of durability, safety, and functionality, is a determining factor in the quality of life and economic development of the society and the competitiveness of its industry and services. As attested to by (Barford, 2002) that due to its size and the long life

of structures, the built environment has a strong impact on society and on quality of life. For instance, the impact of a healthy, comfortable, accessible, usable and safe indoor environment has enormous positive economic impact on productivity, health costs and liabilities

A major challenge in the twenty-first century has been the need to consider human activities within an ecological framework—the sustainability issue. The concept of sustainable building incorporates and integrates a variety of strategies during the design, construction and operation of building projects. It covers (Sam.2006). Reusing buildings and land design for minimum waste, Lean construction, Minimising energy in construction and use, Pollution from construction, Conserving and enhancing Biodiversity, Conserving water resources, Respecting people and their local environment, Transport choices, and Assessing the whole place.

A high amount of energy consumed in a fully air-conditioned building is by air-conditioning and lighting. This energy consumption can be can be saved by appropriate design interventions in building envelope, lighting and air-conditioning system. Generally buildings also consume copious quantities of water for building use and landscaping and generate substantial waste during construction and operation

Conscious efforts need to be made to integrate the environmental parameters into building and settlement planning to achieve the sustainable development. The prime environmental issues that have to be dealt with in totality to ensure sustainable habitats and constructions are:-

2.0 SUSTAINABLE SITE PLANNING

Sustainable site planning essentially looks into the design aspects and optimum utilization of resources available at the site. Development of site for construction purposes disrupts and disturbs the existing natural system. Unsustainable site development process leads to depletion of existing tree covers and depletion of nutrient rich top soil that is conducive to plant growth. The aquifer gets polluted with uncontrolled sedimentation and erosion from the disturbed site. Hard paved surfaces on developed sites give rise to heat island effect and manicured landscape demand copious quantities of water for maintenance. Large sites also have extensive lighting and pumping requirements, which is energy intensive. Construction activities cause air pollution that needs to be controlled. All these issues have to be addressed holistically during site development processes.

The most sustainable and environment-sensitive development is the one that requires very minimal site disturbance. Thus, resource conservation and protection in a given site is of prime importance. Adequate measures should be taken to conserve and protect existing landscape and site features; control erosion and sedimentation; reduce water usage in landscaping; minimise heat island effects; reduce air pollution during construction; In summary, sitting activities can affect the natural environment in the following ways:-

I. Soil degradation affects soil stability, structure and drainage characteristics resulting especially in erosion. Soil degradation can also result through pollution by harmful products or wastes.

II. Degradation of vegetation can occur if erosion, filling/backfilling or vegetation clearing takes place.

III. Ecosystem and soil degradation (e.g. erosion, compaction, changes in drainage, and so on) may occur as a result of construction activities. Soil degradation is a problem particularly where soils are fine or weak, or have complex drainage cycles. Heavy precipitation and steep slopes also present issues. In many cases, soil erosion can be associated with increased sedimentation in waters.

However siting, planning, and design can be environmentally responsible by adhering to the following guiding principles:-

a. Take into account the population density, availability of local materials, availability of public services or resources (e.g. sanitation facilities, public transport, and so on), and the pattern and characteristics of land occupation (e.g. proximity of residences), as well as soil characteristics (i.e. stability, texture, drainage, and so on), proximity to water bodies, topography, climatic conditions, and intended building uses (including needs for maintenance), when selecting the construction site and the technical characteristics of the building.
b. Avoid siting in areas prone to natural disasters or hazards (e.g. flooding, heavy rain, intense storms, earthquakes, landslides, and so on).
c. Avoid infringing on vulnerable sites or sites of economic, ecological, cultural, archaeological, or historical importance (e.g. water bodies, waterways, slopes, wooded areas, coastal areas, arid and semi-arid areas, wetlands, biodiversity hotspots, habitats of endangered species, and so on).
d. Avoid unacceptable changes in ways of life and cultural characteristics (e.g. for indigenous populations, uncontrolled and unplanned human settlements and commercial development, and so on).
e. Avoid sites that would lead to incompatible uses of land and resources (e.g. between an industrial area and a residential area), unacceptable social conflicts (e.g. if the marketing system for traditional products is negatively affected), value conflicts and conflicts with respect to property rights and land tenure, as well as unacceptable changes in the visual quality (aesthetics) of the landscape (in relation to the local architectural style).
f. Integrate environmental conservation and restoration measures (e.g. erosion control and other soil stability measures, protective measures against flooding and heavy rainfall, tree planting, and restoration of degraded sites, and so on).
g. Ensure that international and national/local policies, standards, and regulations are respected (e.g. land use, protected areas, health and safety standards for the construction and use of the building, water effluents, waste management, and so on).
h. Promote soil erosion control measures (e.g. balance cut and fill for minimum deposition of earth; minimize time when soil surfaces are exposed to rain and wind; stabilize soil for example with mulch on vulnerable surfaces; resurface and revegetate exposed areas; implement buffer zones of vegetation on slopes and surrounding bodies of water; implement soil stability structures; keep the mining of clay and limestone for brick making to a minimum, and ensure adequate drainage control and water recycling for this type of activity, and so on).
i. Establish and enforce design and construction standards to ensure that the building is able to withstand extreme weather-related or geology-related events.
j. Others include:-Minimize vegetation clearing, avoid inappropriate use of heavy machinery, ensure proper and timely management of construction materials and wastes (promote the re-use of products when possible). Promote the use of appropriate local materials and building techniques.

3.0 MATERIAL SELECTION

The constructed environments are intrinsically linked to our natural environment. A significant portion of our annual resource expenditures is consumed by the construction industry, largely because of traditional material selection procedures and renovation and construction practices. Apart from structural suitability, the main criteria for selecting building materials until recently have been the up front costs and aesthetics while the environmental criteria have been all but ignored.
The use of green building materials and products represents one important strategy in the design of an environmentally sensitive building. Green building materials offer specific benefits to the building owner and building occupants. Theses, according to Haruna (2007), include reduced maintenance/replacement costs over the life of the building;

energy conservation; improved occupant health and productivity; and lower costs associated with changing space configurations.

Building and construction activities worldwide consume 3 billion tons of raw materials each year or 40 percent of total global use (ECTP, 2005). Using green building materials and products promotes conservation of dwindling nonrenewable resources internationally. In addition, integrating green building materials into building projects can help reduce the environmental impacts associated with the extraction, transport, processing, fabrication, installation, reuse, recycling, and disposal of these building industry source materials.

Material selections also affect air quality. Indoor Air Quality (IAQ) is enhanced by utilizing materials that emit few or no carcinogens (reproductive toxicants, or irritants). Products that have minimal emissions of Volatile Organic Compounds (VOCs), and products and systems that resist moisture or inhibit the growth of biological contaminants in buildings.

Use of building materials like insulation, energy efficient glass can reduce heating/cooling demand by 8-10% (Rouni and Kirn, 2006). Water Conservation can be obtained by utilizing materials and systems that help reduce water consumption in buildings and conserve water in landscaped areas.

4.0 ENERGY EFFICIENCY

Environmental issues in energy efficiency can be achieved through appropriate design interventions and material/ technology selection. One of the primary requirements of an environment friendly construction is that it should have optimum energy performance and yet would provide the desirable thermal and visual comfort.

To optimise energy performance in an environmentally sensitive building involves incorporating solar passive techniques in a building design and enhanced building material specifications to minimise load on conventional systems (heating, cooling, ventilation and lighting). Passive systems provide thermal and visual comfort by using natural energy sources such as solar radiation, outside air, sky, wet surfaces, and vegetation.

Once the passive solar architectural concepts are applied to a design, the load on conventional systems is reduced. In other words, by using renewable energy systems (solar photovoltaic systems/ solar water heating systems) to meet a part of building load, the pressure on the earth's nonrenewable resources can be alleviated by effective use of earth's renewable resources e.g. solar, wind, geothermal, biomass energy.

Energy use in buildings can be drastically reduced by use of low energy materials and methods of construction and reduced transportation energy. An architect should aim at efficient structural design, reduction of use of high-energy building material (glass, steel etc.) and transportation energy and use of low energy buildings materials. Use of environmentally sensitive construction materials and techniques reduce embodied energy content of buildings.

5.0 WATER EFFICIENCY

Proper water management can be achieved through various water management and water conservation techniques, including rainwater harvesting. Water shortage does exist in spite of many sources like rivers & lakes (out of 75% of earth's surface is covered by water, 97% of it is salt water and only 3% is available as fresh water. Of this fresh water, two thirds is in the form of ice caps and the remaining one-third is accessible for usage...ECTP, 2005). This leads to a high cost of pure water and thus stresses the importance of water conservation by way of increasing user efficiency, decreasing the demand on these sources and recycling and reusing wastewater including rainwater

Water conservation measures include use of water efficient fixtures and faucets in buildings; minimize losses, use of water efficient landscape (use of species that need less water), and enhancing efficiency of irrigation equipments. Waste water generated can be suitably treated and reused for flushing and irrigation purposes. Rainwater harvesting or recharge can be practiced (as applicable). Harvested and stored rain water can be reused back into the building or used for landscaping.

6.0 ENVIRONMENTAL POLLUTION

Pollution of the environment (soil, water, air) and other human health sensitivities may arise during building construction and/or building's operational activities. Noise, airborne dust, foul odours, vibrations and traffic pollution may constitute nuisances to the environment during construction activities. Water quality may be degraded and the health of aquatic ecosystems may thus be negatively affected through increased sedimentation and the possible run-off of products and/or wastes. Air pollution (including dust) may arise, depending on the type of activities housed in the building.

Pollution of the environment can be reduced drastically by applying the following measures:-

a. Material selections affect air quality. Indoor Air Quality (IAQ) is enhanced by utilizing materials that emit few or no carcinogens (reproductive toxicants, or irritants); Products that have minimal emissions of Volatile Organic Compounds (VOCs); and products and systems that resist moisture or inhibit the growth of biological contaminants in buildings.

b. Implement conservation and efficiency measures for energy, water and other natural resources / raw materials (e.g. dry cleaning methods before rinsing, closed-circuit water supply for its re-use, prevention of overflow by shut-offs to system, regulation of water flows with valves or high-pressure nozzles, biological and equitable certification, environmentally friendly packaging, and so on).

c. Implement pollution prevention or control devices to limit the harmful effect of pollutants (liquid, solid, or atmospheric), for example, biological wastewater treatment, drainage systems, air filters, proper ventilation, alternative energy sources (for example, solar energy), recycling of scraps, minimal use of dangerous products (e.g. chemicals, laboratory products, solvents, lubricants, oil, batteries, dyes, glue, acids, heavy metals, radioactive substances, and so on) and their appropriate management (e.g. secured storage areas away from vulnerable elements, and storage of flammable products away from all sources of heat or Ignition.

d. Ensure that sanitation facilities are located away from water sources, steep slopes, and vulnerable areas.

e. Promote waste segregation practices to enable the re-use of certain products, recycling of other products, composting of biodegradable wastes, and appropriate storage, transportation, treatment and disposal of other wastes.

f. Avoid creating stagnant water ponds which can be highly odorous and provide breeding grounds for mosquitoes.

g. Promote proper health and safety training, equipment (e.g. masks, ear plugs, gloves, boots, and so on), workspace layout, and work periods.

h. Implement proper cleanliness, maintenance, accident, spill, overheating, fire and/or explosion control measures.

i. Ensure proper training on environmental issues and waste management.

j. If building material production takes place (for example, brick making), promote measures to limit emissions of dust and combustion gases from the kilns (e.g. consider less damaging sources of energy, improved efficiency of kilns, re-use of generated ashes, and so on).

7.0 CONCLUSION

Environmental issues today (Sustainability) demands restraint over use of natural resources. Its realisation requires an integrated design approach involving all key stakeholders in the process of designing, planning and constructing buildings. The architect, landscape engineer, owner, user, electrical, mechanical, plumbing engineers, environmental engineers and energy professionals need to work hand in hand to evolve a sustainable design that is designed to leave minimum environmental footprint and yet not forego any of the modern day comfort requirements of human beings.

8.0 RECOMMENDATION

Achieving sustainable development requires conscious efforts at integrating environmental parameters into building and settlement planning. To accomplish this, the following are recommended:-

1) *Planning barriers*: Currently the building regulations and byelaws do not integrate efficiency within its framework. Building regulations and codes need to incorporate sustainable design features for clearance of construction activities

2) ***Adequate knowledge and awareness:*** The implementing bodies involved in large constructions are often not aware of measures, techniques and technologies that should be adopted to ensure that constructions are environmentally sensitive.

3) ***The Environmental Impact Assessment:-*** The Environmental Impact Assessment (EIA) to be made mandatory for new projects relating to construction of new townships, industrial townships, settlement colonies, commercial complexes, hotel complexes, hospitals, industrial estates, and office complexes above a certain size to obtain prior environmental clearance from the planning regulatory body before starting any construction . The EIA process helps in addressing various environmental aspects such as the management of municipal solid wastes and industrial & hazardous wastes, air pollution arising from vehicles and traffic congestion, inadequate ground water recharge and conservation of water, insufficient public space and green cover, inadequate provision of pedestrian paths and bicycle tracks, sewage treatment facilities and safe disposal etc which the urban planning regulations are not able to address comprehensively. The EIA process ensures integration of environmental concerns into the new construction projects with legitimate public participation and optimal resource consumption practices.

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