DESIGN AND CONSTRUCTION CONSIDERATIONS FOR ENVIRONMENTAL SUSTAINABILITY

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INTRODUCTION

- Abuja is a city well known for its high development density and it is worthy to note that there is close relationship between development density and environmental quality. Historically there has been a close correlation between economic growth and environmental degradation, as communities grow, so the environment declines.

- The consequences of this high density developments witnessed in Abuja includes but are not limited to Traffic congestion, Pollution (air, water & land) problems, Heat island effect, Distortion of micro-climate, energy shortage, waste management challenges and poor quality of life.

- These environmental anomalies will surely abound in any society that places economic consideration above the environment in its infrastructural developments.

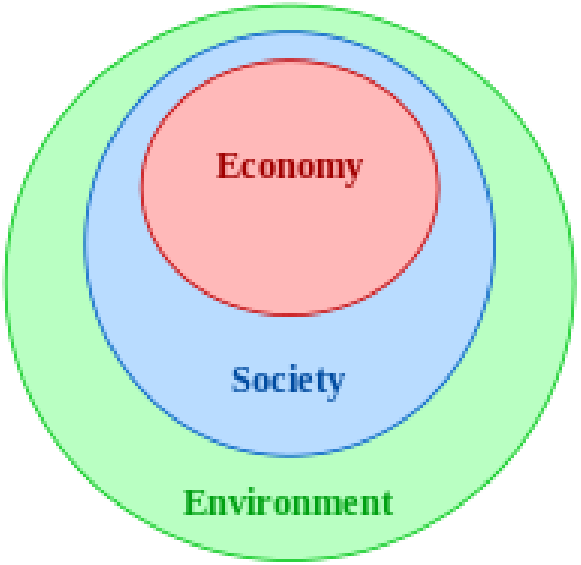
IMPORTANT DEFINITIONS

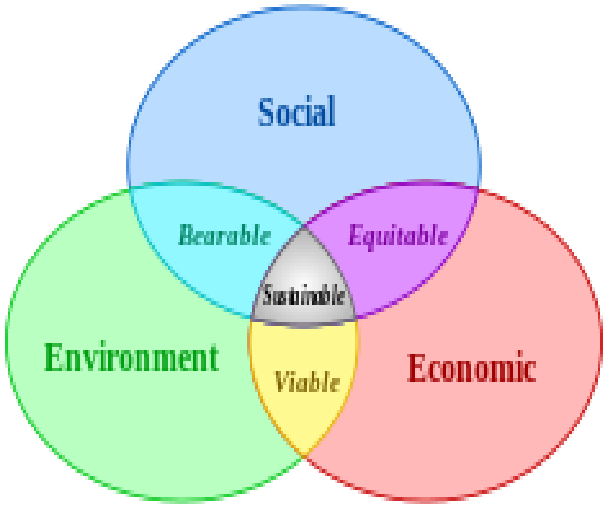
- *Sustainability:* The name sustainability is derived from the Latin *sustinere* (*tenere*, to hold; *sub*, up). *Sustain* can mean "maintain", "support", or "endure.
- *Energy conservation* is the utilization of devices that require smaller amounts of energy in order to reduce the consumption of electricity. Reducing the use of electricity causes less fossil fuel to be burned to provide that electricity.
- *Sustainable design* (aka Environmental design, environmentally sustainable design, environmentally conscious design, etc.) is the philosophy of designing physical objects, the built environment, and services to comply with the principles of social, economic, and ecological sustainability.
- *Sustainable Engineering* is the process of designing or operating systems such that they use energy and resources sustainably, i.e., at a rate that does not compromise the natural environment or the ability of future generations to meet their own needs
- *Environmental engineering* is the integration of sciences and engineering principles to improve the natural environment, to provide healthy water, air, and land for human habitation and for other organisms, and to clean up pollution sites. It also deals with studies on the environmental impact of proposed construction projects and knowledge of environmental engineering law.

SUSTAINABLE DEVELOPMENT

- The concept of sustainable development was defined by World Commission on Environment and Development (WCED) as "A development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs".
- The United Nations Millennium Declaration identified three pillars of sustainable development, which includes economic development, social development and environmental protection.
- However, using a systematic domain model that responds to the debates over the last decade, the Circles of Sustainability approach distinguished four domains of economic, ecological, political and cultural sustainability

CIRCLES OF SUSTAINABILITY





The first diagram above shows the relationship between the "three pillars of sustainability" in which both economy and society are constrained by environmental limits while the Venn diagram shows that Sustainable development is at the center of three constituent parts or circle of sustainability.

SUSTAINABLE DESIGN PRINCIPLES

- Low-impact materials: choose non-toxic, sustainably produced or recycled materials which require little energy to process
- Energy efficiency: use manufacturing processes and produce products which require less energy.
- Emotionally durable design: reducing consumption and waste of resources by increasing the durability of relationships between people and products, through design.
- Design for reuse and recycling: "Products, processes, and systems should be designed for performance in a commercial 'afterlife'.
- Design impact measures for total carbon footprint and life-cycle assessment for any resource used are increasingly required and available.
- Renewability: materials should come from nearby (local or bioregional), sustainably managed renewable sources that can be composted when their usefulness has been exhausted.
- Reduce dependence upon fossil fuels, underground metals, and minerals
- Reduce dependence upon synthetic chemicals and other unnatural substances.
- Reduce encroachment upon nature.

SUSTAINABLE DESIGN

- Sustainable design and construction seeks to minimize the use of resources (including energy and water); ensure that the built environment mitigates and is resilient to the impact of climate change; protect and enhance biodiversity and green infrastructure; provide buildings and spaces that are pleasant and healthy for occupiers and users; ensure the sustainable sourcing of materials; and minimize waste.
- Environmental sustainability entails different diverse disciplines which will includes Sustainable architecture, Sustainable planning, Sustainable landscape and garden design and Sustainable engineering design and sustainable infrastructural development.
- Green engineering (which comprises of both sustainable design and construction practices) attempts to achieve Waste reduction; sustainable materials management; Pollution prevention; and Product enhancement. This encompasses numerous ways to improve processes and products to make them more efficient from an environmental standpoint

GREEN ENGINEERING OR BUILDING STRATEGIES MAKES SENSE

- Economically through

Reduced operating cost-lower energy and water cost, Increased occupant/employee productivity and performance and Increased property values as demand for green products increases

- Environmentally through

Reduced liability, Enhanced occupants employee comfort and health, Heightened aesthetic quality, improved learning, Positive public image, reduced demand on municipal services, Reduced erosion, enhanced and protected biodiversity and ecosystem

- Socially through

Contributions by the community, improved air and water quality, reduced waste streams, conserved natural resources, optimized life-cycle performance of building, minimized strain on local infrastructure and improved overall quality of life.

SUSTAINABILITY GOALS

ENVIRONMENT CONSIDERATION IN OUR DESIGNS AND PROJECTS

- The importance of different urban design considerations in achieving environmental sustainability of an urban renewal project cannot be over emphasized. The factors that formed a basis for evaluation of the environmental sustainability of urban renewal or developmental projects may include "Land Use Planning", "Quality of Life", "Conservation & Preservation", "Integrated Design", "Provision of Welfare Facilities", and "Conservation of Existing Properties'.

- Environmental consideration demands the use of sustainable materials management which is the use and reuse of materials in the most productive and sustainable way across their entire life cycle. Sustainable materials management conserves resources, reduces waste, slows climate change, and minimizes the environmental impacts of the materials we use.

- The pertinent question to ask then is: what are our city developers and planners doing to meet our basic human and infrastructural needs without undermining or degrading the natural environment

Sustainable construction

1. PROCUREMENT – Specific procurement strategies to ensure sustainable construction requirements are addressed.
2. SITE/ENVIRONMENT - Methods to reduce the environmental impact of construction on the project site and surrounding environment are identified.
3. MATERIAL SELECTION - Identifies environmentally friendly building materials as well as harmful and toxic materials that should be avoided.
4. WASTE PREVENTION - Methods to reduce and eliminate waste on construction projects are identified.
5. RECYCLING - Identifies materials to recycle at each phase of construction and methods to support the onsite recycling effort.
6. ENERGY - Methods to ensure and improve the building's energy performance, reduce energy consumed during construction, and identify opportunities to use renewable energy sources

Sustainable construction contd.

7. BUILDING AND MATERIAL REUSE - Identifies reusable materials and methods to facilitate the future reuse of a facility, systems, equipment, products and materials.

8. CONSTRUCTION TECHNOLOGIES - Identifies technologies which can be used during construction to improve efficiency and reduce waste (especially paper).

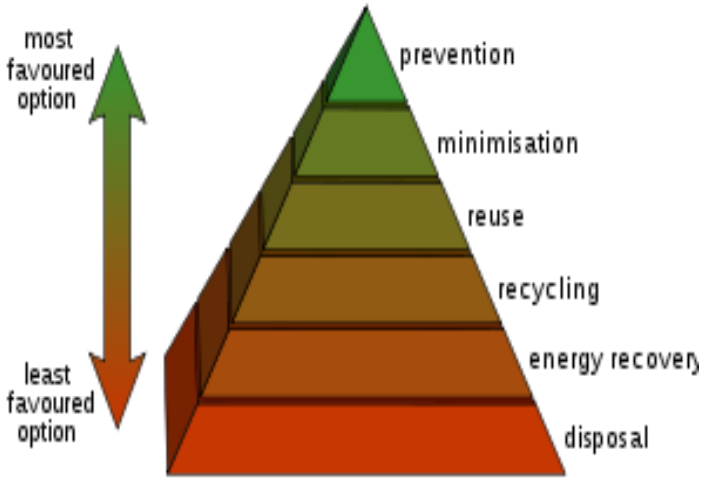
9. HEALTH AND SAFETY - Methods to improve the quality of life for construction workers are identified.

10. INDOOR ENVIRONMENTAL QUALITY - Methods to ensure indoor environmental quality measures during construction are managed and executed properly.

Furthermore, professional project management practices need to be adopted for our developmental projects to be sustainable. Some projects are not properly conceived, poorly estimated, inadequately funded, poorly administered and often shows lack of proper stakeholders engagement and management.

Waste management challenges

- Waste management in FCT experience exhausted waste collection services, inadequately managed and uncontrolled dumpsites and the problems are worsening. Problems with governance also complicate the situation. It is an ongoing challenge and many struggle due to weak institutions, chronic under-resourcing and rapid urbanization.
- All of these challenges along with the lack of understanding of different factors that contribute to the hierarchy of waste management, affect the treatment of waste.



Waste management challenges contd.

- Energy recovery from waste is the conversion of non-recyclable waste materials into usable heat, electricity, or fuel through a variety of processes, including combustion, gasification, pyrolyzation, anaerobic digestion, and landfill gas recovery.

- Resource recovery is the systematic diversion of waste, which was intended for disposal, for a specific next use. It is the processing of recyclables to extract or recover materials and resources.

- Resource recovery is not only environmentally important, but it is also cost effective. It decreases the amount of waste for disposal, saves space in landfills, and conserves natural resources.

EVIDENCE OF INADEQUATE ENVIRONMENTAL CONSIDERATION

- Lack of bicycle path in our cities
- Lack of adequate public transportation system in FCT
- Slow development of light rail transportation system for the city
- Lack of free and well maintained public toilets in public places
- Estate/Residential developments without infrastructures or sustainable planning
- Lack of engineered landfill in FCT
- Inadequate pedestrian bridges and Poor positioning of pedestrian bridges

EVIDENCE OF INADEQUATE ENVIRONMENTAL CONSIDERATION CONTD.

- Weak legislation that gives of LGAs the mandate to manage waste at the satellite towns
- Indiscriminate drilling of boreholes and use of soak away pits in about 80% of FCT residences
- Lack of sustainable power supply to waste water treatment plant at Wupa and inadequate supply of waste water for treatment
- Lack of adequate monitoring of water bodies
- Lack of EIA and proper implementation on some major projects or poor implementation of EIA requirement

RECOMMENDATIONS

- It is during our education that engineers first learn how to approach design, with little or no environmental education. It is time for engineering design to build on ecological science and the interrelationships between their products and various ecosystems. This means that equal attention must be given in University courses to ecological science as materials science.

- Standards and criteria tend to shift responsibility for designing environmentally sound engineering works away from the engineers who can feel satisfied they have discharged their responsibilities if they meet the standards, whether or not those standards are sustainable. Standards tend to be based on what has been economically achieved before, but engineers can push open the boundaries of achievement.

RECOMMENDATIONS

- The new era of sustainable development requires a new approach to engineering design that brings the designer closer to the context of use of the final product, particularly the environmental context. Ecological considerations need to be considered as part of the design process in the way that micro-decisions at every stage of the design or construction process take account of resource and energy use, pollution and sustainability.
- The only way to avoid environmental harm from waste especially construction waste is to prevent its generation . Experience has shown that there is no completely safe method of waste disposal. All forms of disposal have negative impacts on the environment, public health, and local economies.
- Finally, sustainability cannot be achieved without utilizing best practices in Project Management, implementation of Environmental Impact Assessment of any significant development and Joint effort by all project stakeholders.

CONCLUSION

- ✓ Environmental sustainability demands a responsible and proactive decision making and innovation from all of us to minimize negative environmental impact and maintain balance between ecological resilience, economic prosperity, political justice and cultural vibrancy to ensure a desirable planet for all species now and in the future.
- ✓ We have a great role as engineers to promote and protect sustainable infrastructure for the city. The engineer is indispensible when it comes to environmental management

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Thank you