INNOVATIVE AND LOW-COST MATERIAL FOR SUSTAINABLE WATER SUPPLY AND DRAINAGE

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**DECLARATION OF ORIGINALITY**

I, **ALLEN-OKEREAFOR KINGSLEY IKECHUKWU**, hereby affirm that this research work, titled **INNOVATIVE AND LOW-COST MATERIAL FOR SUSTAINABLE WATER SUPPLY AND DRAINAGE**, is mine and that this research has not been copied in part or in whole from any other sources except where duly acknowledged, all external materials used in the preparation of this work has been referenced.

**SIGNATURE DATE**

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**ABSTRACT**

Innovative and low-cost material for sustainable water supply and drainage work is the thrust of this article. The water supply systems of most buildings make integrated use of 3 types of systems, namely the direct supply system, indirect supply system and sump and pump supply system. Under the direct supply system, fresh water is transmitted directly from the public water mains to households at lower floors by means of hydraulic pressure inside the mains Under the indirect supply system, a water pump is used to draw water from the storage tank installed at the ground level of the building, and fresh water drawn into the rooftop water tank is then transmitted to each household through a network of sub-mains.

Drainage systems can be classified into the rain-water pipe system and sewage pipe system. The integral parts of a drainage system comprise the drain, pipes, traps and manholes. Drain, pipes should by no means be connected in an improper way, e.g. sewage discharged from sinks should not be emptied into any rain-water pipe. The study advices innovative and low-cost material for sustainable water supply and drainage work. The methodology adopted in this article was descriptive approach involving the study Innovative and low-cost material for sustainable water supply and drainage work in engineering infrastructures in Nigeria.

**CHAPTER ONE**

**INTRODUCTION**

**1.0 BACKGROUND OF STUDY**

This article provides information on the use of low-cost material for sustainable water supply and drainage work, specifically materials that can be seen as ‘sustainable’. The applicability of building materials is always determined by the following local circumstances: the availability of raw materials; the culture of making building materials; the construction methods; the power of individuals, households, and residents’ groups; and the willingness of entrepreneurs to participate in drainage construction. In theory, all the housing that is needed in the [Global](https://www.rroij.com/global-research-in-computer-science.php) South could be built by corporations or building companies. However, in the low-cost housing market. In this article, I discuss three types of sustainability: technical sustainability (durability), [climate](https://www.omicsonline.org/environment-pollution-climate-change.php) friendly sustainability, and social sustainability. The use of sustainable building materials is important for the incremental processes of self-managed house construction and home improvement. Low-incomes households should always be able to buy good-quality and affordable building materials. When households and communities participate in house construction, they can significantly lower the building costs.

Low-cost materials being used in housing, also in low-cost housing. High-quality means among other things that the materials are long-lasting, have nice features, and require only a little maintenance. This can be called ‘basic durability’. A home must provide protection against the effects of the regional climate condition, such as coldness and heat, wind, rain, etc. In addition, the house must offer the residents safety and privacy, and it should never collapse. [Natural](https://www.omicsonline.org/natural-products-chemistry-research.php) disasters, such as earthquakes, tropical storms, and floods, place unique technical demands on the dwellings’ structures and materials. In areas that are seriously threatened, the construction of houses must be prohibited, through adequate planning regulations, especially in areas that can’t be protected by technical measures such as dikes in flood areas. Due to climate change, natural phenomena are becoming more violent, and thus the requirements for the durability of a building’s structure and its materials need more attention.

**ABOUT DURABILITY AND SUSTAINABILITY**

Besides the durability aspects of low-cost materials, sustainable house building also stems from other motivations, namely protecting the environment, the climate and the natural resources. Often, the objective (of the governments, and sometimes the residents) is that housing does not contribute to climate change or emissions of greenhouse gases- CO2 gas in particular. If the import of concrete building materials and the associated high transport costs can be avoided, the (climate) benefits are immediate. If the use of fossil fuels can be avoided, both in the procurement of raw-materials and in the production and the transport of materials, environmental benefits are gained.

**CHAPTER TWO**

**LITERATURE REVIEW**

**2.0 DRAINAGE AND WATERWORKS**

Drainage is the natural or artificial removal of a surface's water and sub-surface water from an area with excess of water. The internal drainage of most agricultural soils is good enough to prevent severe waterlogging (anaerobic conditions that harm root growth), but many soils need artificial drainage to improve production or to manage water supplies.

Water supply is the provision of water by public utilities, commercial organisations, community endeavours or by individuals, usually via a system of pumps and pipes. Irrigation is covered separately.

Low-cost materials are always not advisable as to the fact to the fact they always believe it won’t do the job well but with recent research it has been discovered that a lot of low-cost materials serve very well. In the aspect of drainage

The civil engineer is responsible for drainage in construction projects. They set out from the plans all the roads, street gutters, drainage, culverts and sewers involved in construction operations. During the construction process he/she will set out all the necessary levels for each of the previously mentioned factors

Civil engineers and construction managers work alongside architects and supervisors, planners, quantity surveyors, the general workforce, as well as subcontractors. Typically, most jurisdictions have somebody of drainage law to govern to what degree a landowner can alter the drainage from his parcel.

**2.1 DRAINAGE OPTIONS FOR THE CONSTRUCTION INDUSTRY INCLUDE:**

Point drainage, which intercepts water at gullies (points). Gullies connect to drainage pipes beneath the ground surface and deep excavation is required to facilitate this system. Support for deep trenches is required in the shape of planking, strutting or shoring.

Channel drainage, which intercepts water along the entire run of the channel. Channel drainage is typically manufactured from concrete, steel, polymer or composites. The interception rate of channel drainage is greater than point drainage and the excavation required is usually much less deep.

The surface opening of channel drainage usually comes in the form of gratings (polymer, plastic, steel or iron) or a single slot (slot drain) that runs along the ground surface (typically manufactured from steel or iron).

**2.2 THE USE OF LOW-COST MATERIALS**

The construction aspect must always be well attended, meaning it requires adequate foundations and structures. Below, attention is given to the following five groups of building materials.

1. Bamboo and timber

Bamboo has a lot of potential as a building material for low-cost drainage and water works. In various countries in Latin America and Asia, bamboo housing is customarily a rural phenomenon, based on local production and processing of the raw material. If bamboo houses were to also become accepted by city dwellers, there would be a need to develop vast bamboo plantations to provide the urban housing markets with bamboo for construction. Bamboo can be used in countries where it has a natural presence. One must choose the right sort of bamboo. For example, the species Guagua angustifolia is native to South America and has the best properties for construction. However, a bamboo housing study conducted in Guayaquil, Ecuador [11], found that gradually after a site has been developed, e.g. by the provision of paved roads – the squatters’ bamboo houses are transformed into concrete houses. This is because the residents eventually prefer a house built with bricks because bricks have a higher status. In a similar example, the NGO IDESAC in Guatemala tried to cooperate with families in rural areas to stimulate house building with bamboo. They found, however, that the concerned families see bamboo as ‘the poor man’s construction material’, and thus they don’t want to use bamboo for their houses (according to Arch. Luis Estrada of IDESAC, interviewed by the author in August 2016). So far, the use of bamboo as a construction material in urban settlements is still limited, but the material is sustainable (in an eco-friendly sense) and a bamboo house is earthquake resistant if constructed well. The construction of complete houses of bamboo, with a strengthening framework, requires technical expertise. If it is done by self-builders, there should be technical assistance by specialized carpenters. Bamboo must be treated with preservers, often chemicals, to prevent termites from destroying it. If bamboo is not treated, the material must be replaced within 5-10 years. If the material is treated well and is under the cover of a roof, it can stand 30-35 years [4]. It is recommended that the outer walls of the bamboo homes are plastered, in order to give protection against the influences of the climate and insects. If the external walls of the house are completely plastered, the houses can look like an ‘ordinary’ house. Currently, there are some promising technological innovations concerning the construction of homes with bamboo. For example, there are strengthening corner joints, and prefabricated wall panels that can be used for exterior walls. It is to be expected that there will be more of such innovations on building homes with bamboo. The use of bamboo as a major construction material in dense urban areas is not to be expected but dividing walls and woven bamboo mats for covering floors can be used in urban housing too.

Using timber in house construction is comparable to using bamboo, but it is easier to handle. The use of timber in construction is customary worldwide. A structure of timber can be combined with bamboo walls that will be plastered, and of course also with other materials. One must consider transportation costs and the replanting of trees in the area where the wood was harvested. Building completely wooden houses in dense urban areas is not recommended because of the danger of fires; this aspect must always be considered and controlled also in non-regulated urban areas. Making frameworks is essential in earthquake areas, and in areas that can flood houses can be built on stilts

2. Geotextiles

New drainage systems incorporate geotextile filters that retain and prevent fine grains of soil from passing into and clogging the drain. Geotextiles are synthetic textile fabrics specially manufactured for civil and environmental engineering applications. Geotextiles are designed to retain fine soil particles while allowing water to pass through. In a typical drainage system, they would be laid along a trench which would then be filled with coarse granular material: gravel, seashells, stone or rock. The geotextile is then folded over the top of the stone and the trench is then covered by soil. Groundwater seeps through the geotextile and flows through the stone to an outfall. In high groundwater conditions a perforated plastic (PVC or PE) pipe is laid along the base of the drain to increase the volume of water transported in the drain.

**CHAPTER 3**

**3.0 CONCLUSION**

All of the building materials described above is sustainable in a certain way. The possible applications of these materials depend on local and regional circumstances. In each country or region, the specific conditions of the soil and the plants and trees, etc., can be examined, to find suitable soil for bricks and plants (bamboo, etc.) for the making of building materials. It is beneficial if the use of wood for housing is reduced, either by using an alternative material with similar properties (bamboo instead of timber) or by producing bricks made of soil so wood is not burnt to fire the bricks. Taking these steps against deforestation helps to achieve climate objectives. The creation of bamboo plantations can also help herewith.

The earth-block technologies are emerging in many countries and in general this is well supported. This development creates opportunities for the local extraction of raw materials for useful and cheap building materials that can be processed locally in the housing construction industry. By providing vital technical assistance, technical aid teams enable residents to produce and apply sustainable building materials for the construction of their homes. Technical assistance can be provided by aid organizations such as housing NGOs, local authorities, and building materials producers and traders. Local government building control is always a capstone in the building process. The available power of local communities is to be used by the local authorities in their housing policy to stimulate the construction of adequate (low-cost) housing for their citizens.

There are several limitations regarding the application of the presented building materials. For example, there may be organizational, political, and financial constraints. Aid agencies can often play an important role, in several respects. However, the authorities should create the right conditions. In each country, a technological institute can follow the technical developments and investigate the possibilities and limitations of certain building materials and aid-giving models. Due to the growth of cities and urban regions worldwide, in the future the focus of the promotion of sustainable building materials will increasingly be on semi-urban applications, in projects with higher housing densities. This presents a challenge for the improvement of sustainable building materials. Herewith, technological development and increasing the scale of the production of these sustainable materials are important**.**