Affordable building materials from recycled agricultural waste, Zaria, Nigeria

project goals

Our project goal of creating a catalyst with which to address the subject of sustainable construction in the context of Nigeria, can only be effective if combined with specific socio-cultural issues pertinent to many developing economies. These issues include: agricultural/waste recycling (economy) • sustainable resource management (research/engineering) • provision of affordable shelter (architecture)

The detailed goals will be explained as follows:

1) sustainable construction and economy

- valoration of farming as an important resource
  Truly sustainable development is only meaningful, if coupled with a parallel improvement in local economic opportunities, as well as environmental protection.

- in terms of employment, agriculture is by far the most important sector of Nigeria’s economy, engaging about 70% of the labor force.

- relatively small farms produce about 80% of the total food supply. About 10.7 million hectares, or 23% of Nigeria’s land area, are under cultivation. 

- coupled with this advantage, Nigeria’s diverse climate, from the tropical areas of the coast to the arid zone of the north, make it possible to produce virtually all agricultural products that can be grown in the tropical and semitropical areas of the world.

- this is of enormous advantage for a construction industry that could benefit from agricultural waste products.

- empowering farmers
  At a local level, should the abundant plant based agricultural waste from land cultivation no longer be incinerated at great disadvantage to the environment, recycling them could help in reducing poverty by offering an added income earning opportunity to local farmers who can now sell their holistic “waste materials” to local producers.

- fostering entrepreneurship
  As the economic interest in recycling is raised, the gathering of these materials on a larger scale has the potential to further strengthen local economies, promote economic modernisation and diversification and help reduce poverty by offering an extensive job market for the collection, and a higher income earning opportunity for entrepreneurs who are interested in establishing a network for the distribution of these agricultural waste materials.

- economic sustainability
  Now importantly, the utilisation of these local materials should reduce the need to rely on more expensive, imported, non sustainable building materials.

1) sustainable construction and engineering research

- leverage effects, interdisciplinarity
  By researching and producing composite building materials from vegetable waste using low technology, our project will help local agronomists, engineers and architects, and propagate an integrated method of crop cultivation and crop waste management.

- working with our partner institutions, we promote a multi-disciplinary approach to problem solving that ensures a transfer of knowledge across various disciplines in an investigative framework.

- empowerment through research education
  Our project aims to create learning tools that are suited to the environment and the local community who is largely engaged in agriculture.

- innovative production
  Faced with acute shortages of fossil fuel resources along with rising prices, the interest in natural adhesives and glues has recently risen on the horizon.

- our research successfully deployed Tanins as an alternative to synthetic adhesives for the production of the composite panels. Extracted from wood and bark, Tanin-based adhesive is free of Formaldehyde and consequently a sustainable alternative Adhesive for partecipbard

2) sustainable construction and architecture

- local materials
  Our research investigated the applicability of corn cobs, rice husks and groundnut shells as raw materials for composite panels to be produced and used in Nigeria.

- single layer composite panels based on these materials were produced at laboratory scale, using different parameter sets for density, moisture load, press temperature, moisture content and particle size. To avoid formaldehyde emissions, tanin hexamine formulation was chosen.

- the panels were tested according to EN standards for used based panels. The mechanical properties of particulateboards derived from rice husks and groundnut shells failed to satisfy the standard requirements. These materials may potentially be used as thermal insulation and decorative cladding material.

3) sustainable construction and architecture

- local practises
  We are now in the process of establishing a physical workshop in the partner university, where the acquired knowledge and practical experience tempered with locally derived expertise and indigenous architectural styles and construction technologies in the context of sustainable construction?

- local architecture
  Our ultimate goal is to erect prototype case-study units using the new composite materials that are informed by local customs to meet local comfort and aesthetic demands. As a consequence, the design and construction of the low cost housing proposals will be done in close collaboration with: 

- the future users of the buildings who will be able to shape them according to their needs... the local craftsmen to introduce valuable skills and transmit acquired knowledge.

The pilot project will deliver valuable information with regard to technical details, durability, comfort, indoor environment, etc. Future users will have the opportunity to influence the pilot project thus guaranteeing its future acceptance.