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Circular and Ecological Economy (CEE) : A Panacea to Enhance Sustainability of Communities and Industries in Accra and Tema Metropolitan Assemblies (AMA and TMA) of Ghana.

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Abstract

The Circular Economy (CE) proposes a radical shift in how we interact with nature, aiming to conserve resources, close materials and energy loops, and foster sustainable development at all levels – from individual consumers and businesses to entire cities and regions (Geissoerfer et al., 2017). This research focuses on Industrial Ecology (IE), which draws inspiration from nature's efficient resource cycling to design closed-loop systems within industrial parks and regions. Biological ecosystems excel at recycling resources, minimizing waste and maximizing resource utilization. They serve as powerful models for industrial systems, demonstrating the efficient (re)cycling of materials and energy. It takes a localized approach, developing closed-loop systems tailored to specific industrial parks or regions. This approach addresses the unique challenges and opportunities of each location, optimizing resource flows and minimizing environmental impact (Korhonen, 2001). Eco-industrial parks (EIPs) like RADA in China and Eco 3 in Finland exemplify successful implementations. These parks showcase how resource sharing including energy, materials, information, and expertise can enhance economic performance while reducing waste and pollution.

Keywords : Circular Economy, Industrial Ecology, Natural Ecosystems, Closed-Loop Systems

Introduction and Context of Study

The Circular Economy involves a five-phase supply chain across multiple industries: taking resources, manufacturing products, distributing them, using them responsibly, and recovering materials at the end of their life cycle (Prieto-Sandoval, Jaca and Omazabal, 2018). The Circular Economy emerges as a transformative philosophy optimizing various aspects of businesses to propel society towards sustainability. It goes beyond just environmental considerations, encompassing financial, social, technical, ecological, and institutional factors. It aims to change entire systems, not just individual parts. Active involvement of businesses, consumers, government, and other stakeholders is crucial. Minimizing pollution across land, sea, and air is a core objective. Agriculture, Construction, Wood and Plastic production are enablers of economic growth but without their production

in circularity and when done in linear economy mode of 'take , make, use and dispose of waste is a main contributor of natural resource depletion, environmental degradation, climate change and has negative effects on human health. Plastics, for instance stays over 500 years to break done and this causes harm to biodiversity including marine and ecosystem needed to support life.

Ghana with population of 30 million generates waste output of 22,500 tons per day and 80% of waste services (Waste and CE Report Ghana, 2019) . Our outreach coverage, AMA and TMA have waste output of 1kgs /ppd with population of 2.7 million and waste of 2,700 tons per day. Only 25 industries recycle 320 tons therefore, one will agree that the science of CEE conserving and procession of waste through ten " R Strategies" is very minimal and the project will promote the above to help save species being choked with plastics leading to extinction in ocean and reduce open burning of waste to cause climatic disturbances and health hazards. To enable CEE, resource efficiency and environmental sustainability in AMA and TMA, requires actors like us to interact with the citizens to appreciate the transformation of linear economy to CEE in order to enjoy healthy environment and life.

Problem Statement

Ghana's waste management system faces a critical challenge, threatening environmental health, public safety, and economic prosperity. Daily, an estimated 12,710 tons of solid waste are generated, but less than 20% are collected and disposed of properly. This staggering statistic paints a grim picture of a system struggling under the weight of its own waste.

Research Promotion and Objective

One of the key aims of the outreach team is to prepare brochures, leaflets, polo shirts and others that focuses on promoting a CE ecosystem through driving waste management market with proactive measures to decrease dumping, burning and adopt waste-energy technologies and practice of the 5 Rs (Refuse, Reduce, Reuse, Rot, and Recycle) and principle of " reduce, reuse and recycle delivered through five field of actions -take, make, distribute, use and recover (Omazabal, Prieto-Sandoval, Jaca & Santos, 2016) by Waste actors and community members. The research has objective of strengthening waste management market within the two Metropolis to establish a clean-living environment by co-designing waste-energy technologies and strategies .The idea encourages transformation of solid with liquid waste to generate biogas for cooking and electricity and compost.

Relevance of Study

The study helps save energy, reduces rubbish output, which decreases the number of trash pickups, fewer trips to landfills, less fossil fuels burned by garbage trucks, avoidance of open burning to cause climatic disturbances , reduce pollution and health hazards. The use of biogas that eschews felling of trees for use as firewood and provide clean cooking to avoid negative effect on climate change and air pollution will also be promoted at community gatherings and durbars. Strengthening of CEE environment and market within the two metropolis to establish a clean-living environment clubs, associations and behavioural change towards waste, agriculture -energy nexus technologies and strategies such as transformation of solid with liquid waste to generate biogas for cooking and electricity, and

compost for climate smart agriculture. Existence of save energy, reduced rubbish output, which decreases the number of trash pickups, fewer trips to landfills, less fossil fuels burned by garbage trucks, avoidance of open burning to cause climatic disturbances and reduce pollution and health hazards. Furthermore, use of biogas to eschew felling of trees for use as firewood would be encouraged. The use of compost to improve soil fertility to support climate smart agriculture, where a scale up will adopt the biomass pyramid (production of pharmaceuticals and food additives). Various dumpsites and landfills visited by the actors to take waste deposits which will be analyzed with Land GEM software to estimate the potential generation of methane and its impact on climate change.

Research Questions

The research questions which are intended to be answered cut across effective promotion, design, development and implementation of CEE Sustainability.

Who are major stakeholders and their technologies deplore in CEE ?

How do stakeholders utilize the technologies and strategies of CEE to enhance sustainability in their communities and industries ?

What CEE promotions, technologies and strategies work and what does not work?

What economic, social, technological and ecological performance process and framework needs to be available to ensure sustainability?

Conceptual Framework

The concept explores EIP which acts in improving economic, social, technological and social performance through the utilization of resources while diminishing waste generation and pollution to enable sharing of energy, material flows, information, or other resources (Allenby, 2000). The investigation to ascertain improvement of the above system would be done through ten (10) " R Strategies") in all the stages of refuse collection (R0), marketing of the waste the product(R1), reduction of waste of waste achievement (R2), reuse by another(R3), repair(R4), refurbish(R5), Re manufacture(R6), repurpose(R7) resources recycling (R8) and energy recovery (R9) and the building capacity of the actors in the CE Ecosystem Waste industry. Engagement of actors such as school pupils participation in conferences , Churches, Communities, Women Groups, Construction and Demolition Companies, Sector Ministries , Restaurants and Hotels, Environmental Service Providers (ESPA), NGOs, Wood Workers, Forestry Workers, Farmer Based Organisations (FBOs). Local Service Providers in Waste, Ghana Plastic and Waste Manufacturers Association, , Statutory Agencies in Accra and Tema, rePATRN, Skyfox, , Universal Plastic Product and Recycling (UPPR) , International organisations (GIZ, JSO Group, UNDP, USAID, Royal Netherlands Embassy in Ghana in symposium and debate in environmental recoveries and ecological citizen science would be undertaken in the field works.

Researcher further investigates the following :

I. Level of sensitisation and industrial ecology awareness among actors in their industrial ecology clubs formed (appreciation of transformation from Linear economy (LE) to CEE).
II. Behavioural Change of throwing waste into the sea/ rivers/ lakes to cause water pollution and choking of species to death ,open spaces to contaminate the soil, drains to choke culverts causing floods and loss of biodiversity thereby leading to infectious diseases.

III. Increased proactive measures to decrease dumping, burning and adoption of waste-energy technologies and practice of the 5 Rs (Refuse, Reduce, Reuse, Rot, and Recycle) and delivered through five field of actions to take, make, distribute, use and recover.
IV. Engagement of actors including schools, churches/ mosques and communities participation in conferences , symposium, workshops, and others.
V. Evaluation of participation of communities and industrial ecology actors including companies, youths, women/girls) and men/ boys with access to a new or upgraded waste technologies, reflecting strengthened supply and demand thereby decreasing ecological degradation and increasing of revenue.
VI. Structures based on strengthening the enabling environment and building the capacity of the actors and increasing the linkages between the private and public sectors.

Methodology

The approach that would be used to elicit information from the above 50 respondents would be mixed methods (qualitative and quantitative) using literature review, survey, focus group discussion and case studies. First, constructs and sub constructs would be identified for analysing the research questions through review of secondary information and an analytical framework would be developed for the study.. Second, current state of CEE practices in the TMA and AMA communities and industries of Ghana and hypothesis relating CEE fields of actions with sustainability on economic, environmental and social performance is also developed. Data would be collected through survey instrument in consonance with the hypotheses and the correlations among the CEE field of actions and sustainability performance through statistical analysis. Third, a focus group would be organised with sole purpose of identifying customers, community members, policymakers and implementers, researchers and planners in order to ascertain issues, challenges with the view of deriving opportunities for implementing CEE. Forth, three case studies would be undertaken to derive strategies, resources and competences for CEE within the communities and industries and validate the overall findings of the research questions. NVIVO, GEM and SPSS would be used to provide perspective of the representatives.

Research Plan

The research will be presented in three main parts:

- ✧ Chapter 1 presents the introduction, purpose, background of the study, statement of problem, research objectives and questions.

- ✧ Chapters 2 and 3 present information on stakeholders' analysis and cooperation, effective promotion, design, development and implementation of CEE sustainability. Measuring stakeholders utilization of the technologies and strategies of CEE to enhance sustainability in their communities and industries are clearly defined in various levels as an aspect of literature review and methodology.

- ✧ Chapters 4 and 5 present data presentation, analysis and discussions, summary, conclusion and recommendations on economic, social, technological and ecological performance process and framework needs to be available to ensure sustainability.

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