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5. Green Innovation and Technology

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Figure 5.1: Green Technology

Abstract:

Green extraction is a growing field in extraction processes that is gaining popularity in the term "green innovation," also known as "eco-innovation," signifies a final process that is focused on creating new technologies and methods of production with the goal of reduced risks to the environment, such as pollution and resource exploitation. In particular, this GI (Green Innovation) has boosted organizational flexibility and cost-efficient operation. These days, GI plays a crucial part in the growth of a number of corporate sectors in order to boost their market share and ensure long-term stability. Many cities and organizations are turning to green innovation as a means of ensuring both economic growth and environmental conservation since environmental degradation eventually poses a serious threat. Green innovation technologies are characterized by their economic compliance, eco-prevention focus, methodical approach, and higher efficacy rate. As a result of the recognition and perceived significance of sustainable development in the last decade green technologies gained a substantial amount of attention in the manufacturing industries due to its huge benefits for the society.

By integrating private sector innovation and involvement with the backing structure of national and international policy, "green growth" aims to provide avenues for sustainable development. Its three main goals are to concurrently confront poverty reduction and development, secure a more environmentally friendly world, and establish new, thriving economies based on clean technologies. Green innovation poses equal obstacles and an opportunity in the present-day workplace for an enterprise that must pursue both business objectives and social responsibilities. In order to mitigate risks and optimize positive aspects, enterprises must assess their own competence for green innovation.

Keywords:

Green technology, green growth, sustainable practices, green innovation.

5.1 Introduction:

Green innovation, referred to as innovation in green technology[1-11], thus provides potential conversational remedies to some of the world's major development and sustainability challenges; yet, this potential additionally calls for a proactive relationship amongst the public and private sectors. Global research and development capabilities have somewhat evolved as a result of the progressive credo of broad economic development.The transition to cleaner energy sources becomes more challenging for nations that are developing because their pursuit of quick development often obscures the need to produce cleaner energy sources.Despite yet, there have been numerous attempts to expand it to a particular extent and commercialize it, but up to now, neither among the objectives has been met in order to tackle the pre-existing challenges.Even though there is a lot of space and potential for action to tackle environmental issues and spur economic growth, the concentration of innovative innovations, such as clean technology innovation, remains centralized in high-income nations. The flow of invention adaptation is always slow and starts at the top and works its way up to the bottom.

5.2 Green Innovations and Their Examples:

The Practical examples and Innovations of Green Innovations are listed below:

A. Coconut Coir: The purpose of this study is to investigate the sustainable reuse of agricultural waste through the use of coconut waste in evaporative cooling pads. Two varied compositions of coconut litter are investigated in a laboratory setting, with varying rates of aeration. Comparisons were made between commercial paper strips and the mass transfer coefficient of heat, evaporation cooling efficiency, and pressure drop. Based on the data, it can be concluded that the coconut charcoal had a cooling efficiency of almost 50%, or nearly 47% of the commercial pad. Coconut coal has an average pressure gradient of 1.5 to 5.1 Pa. Additionally, a study on the cooling ability of coconut charcoal in central Thailand's normal weather revealed that air temperatures after exiting the line varied between 23 to 28°C.

Another use of Coconut coir is in the cement industry. A widely used building material, concrete for economy and local availability. Concrete types, such as lightweight and high-strength concrete, meet specific requirements by varying the composition of the mix and

the composition of the materials. However, high-strength concrete faces brittleness due to microcracks from high binder to low water ratio, which affects long-term durability. Frequent reinforcement with steel rebar reduces this, but does not change the strength of the shrinkage of concrete. Fibers such as steel and polypropylene increase tensile strength and stiffness, although their addition increases cost and carbon footprint. In order to reduce these impacts, researchers are exploring environmentally friendly alternatives such as recycled tire metal fibers and natural fibers (e.g. Coir). Coir from coconut blocks stands out for its low cost, durability and resistance to salt water, making it suitable for a variety of applications including concrete reinforcement and geotextiles.

B. Banana Leaf: Whenever concerns about food waste surfaces some commonly used polymers include PET and PP, PS, HDPE, PVC, and LDPE, most of which are petroleum-derived and non-biodegradable. Plastic food packaging contributes significantly to plastic waste worldwide, causing more than 150 million tons of waste per year, causing damage to the environment. Biopolymers derived from renewable organic materials are seen as potential alternatives to conventional plastics but face challenges in terms of cost of production, manufacturing and processing Packaging materials the choice of materials depends on food quality and storage conditions. Flexible packaging is mainly for products such as salads and fruit, while dry goods require more protection against obstructions. A practice based on Indian tradition, the use of plant leaves for packaging results in biodegradable and antimicrobial materials. Banana leaves in particular extend the shelf life of foods and have various health benefits due to their antioxidant and antioxidant properties The research aims to process banana leaves to extend their shelf life and enable them to last longer for various packaging materials.

Another use of banana leaf is as concrete material. The basic development of a country is a strong infrastructure, including housing and transport infrastructure. The importance of concrete in this development poses environmental challenges due to the use of materials and CO2 emissions. Known for its versatility, self-compressed concrete (SCC) is sought after for its efficiency but faces cost and environmental concerns due to cement content Researchers are exploring environmentally friendly alternatives such as banana leaf ash (BLA) and other agricultural a -products. Despite the limited research on incorporating BLA into conventional concrete and SCC, its feasibility should be investigated. Researchers are evaluating the effect of BLA on the characteristics of SCCs by considering efficacy, strength, durability, and environmental factors. BLA, a promising pozzolanic material, offers both technical advantages and environmental sustainability, making it a viable alternative for sustainable construction.

C. Water Hyacinth: The tannery industry is notorious for its harmful effects on the environment, especially due to the high levels of toxic wastewater in tannery. These wastewaters loaded with various chemicals and heavy metals of chromium pose a serious threat to human health and ecosystems when inappropriately discharged into water and soil. The proliferation of synthetic leather products further compounds this issue, as nearly 90% of leather manufacturers use such processes, resulting in harmful environmental pollution.

In an effort to reduce the environmental impact of tanning wastewater, researchers have investigated various wastewater treatment methods. Of these, phytoremediation, the natural process of removing toxins from the environment through plant-based systems, has found

attraction the Water hyacinth, an abundant aquatic plant known for its fast growth and ability in absorbing impurities holds promise as a potential reagent for the treatment of leather wastewater. Researchers carried out studies to investigate the effectiveness of water hyacinth in treating leather with a focus on extracting therapeutic agents from its leaves using various solvents such as ethanol acetone, on distilled water and other filters

Research in places like Ethiopia is aimed not only at addressing environmental degradation but also at exploring potential economic opportunities associated with the use of water hyacinth for wastewater treatment of natural remedies by exploiting them.

Introduced as an ornamental crop, the water hyacinth has become a threat due to its adaptability and absorption of human activity. In the 21st century, it is being explored as an alternative fuel source due to its ability to efficiently convert biomass into energy. Its rapid development makes it a renewable energy source, with the potential to replace fossil fuels.

In addition, they can be used as bricks in coal plants, reducing their dependence on coal. Water hyacinth also improves soil fertility and acts as a bioremediation for wastewater. Its applications need to be considered in terms of energy, technology and environment.

D. Bioplastics: Society is moving towards a bio-based circular economy with emphasis on sustainable use of bioresources. Forestry and agricultural and industrial wastes are major sources of lignocellulosic biomass, which are used in various industries such as paper, bio composites, biofuel production, etc. Bioplastics from renewable sources such as corn and sugar provide products as it is an eco-friendly alternative to conventional plastics. Some bioplastics are biodegradable, while others, such as bioPE, are not. Lignocellulosic resources have the potential to replace mineral-based products, but challenges remain in their production and economic development. Bio-based products are essential for sustainable development, requiring innovation, supporting systems and market opportunities. However, land use problems and competition for food production are increasing the need for bioplastics from non-food sources such as forest bacteria.

E. Bamboo: Clothing is essential to human life, and is made from natural fibers such as cotton, wool, silk, or synthetic materials such as rayon or nylon. But many garments contain many chemicals, often unnoticed by users, including up to 600 synthetic chemicals and common chemicals such as aldrin and benzo. Those chemicals this can lead to a variety of health issues, from minor skin ailments to more serious conditions like cancer- prostate, pancreas, liver and bladder cancer (Cantoria, 2010).

Organic clothing offers a safer alternative, growing crops without pesticides. Fibers from these crops are processed without any chemicals, providing consumers with a healthier option. As environmental concerns rise, fashion brands are increasingly turning to eco-friendly fabrics such as cotton, silk and bamboo. In addition, new sustainable fibers from trees, fruits, and other natural sources are being explored, expanding the possibilities for environmentally friendly clothing. Bamboo in particular stands out as a tree the fastest growing on earth, providing renewable sources for eco-friendly clothing. As the demand for sustainable fashion increases, the industry continues to evolve and reduce its environmental footprint by providing them with safe and eco-friendly clothing.

Properties of bamboo fiber include - Antibacterial property, Anti UV property, Thermal regulating property. Bamboo is also now used as a replacement of cotton in pads. Bamboo fibers in particular excel as woven wadding, being nine times more absorbent and nearly twice as absorbent as standard cotton clean pads. This superiority comes from its unique cellulose structure, which maximizes water consumption by walling the over tension and space between water and fiber that can break over penetrate.

Studies confirm bamboo wadding has exceptional absorbency, with recent research showing 3-4 times more absorbance than cotton, and odor from its numerous small pores and small gaps are reduced.

Despite the feasibility, the widespread use of bamboo wadding requires complex manufacturing processes and initial investment costs. However, non-governmental organizations (NGOs) can play an important role in facilitating the production and distribution of small products, especially in low- and middle-income countries, and can transform menstruation hygiene practices.

Future research should prioritize testing the safety and durability of bamboo wadding for menstrual use. This includes assessing its resistance to washing and maintaining water absorption over time, as well as assessing the safety of the chemicals used in its manufacture. Addressing these problems could provide a more sustainable and effective alternative to traditional hygiene products, including menstrual hygiene that goes global.

5.3 Benefit of Green Innovation:

Benefits:

- Improvement and protection of biodiversity and ecosystems
- Enhance the air and water quality
- Diminishes waste streams
- Conserve and retrieve natural resources
- Optimize the economic performance
- Elevate indoor air quality
- Minimize strain on local utility infrastructure

5.4 Conclusion:

By establishing more sustainable heavy infrastructure and expanding other economic sectors, green growth offers a way to meet economic, environmental, and development objectives. This strategy places a strong emphasis on technical innovation and a cooperative approach between the public and commercial sectors. To guarantee the success of this approach, it's vital to:

- Support innovation for the Base of the Pyramid (BOP) and lower margin innovation.
- Address the challenges of sharing intellectual property (IP).
- Create new business plans and budgets.

- Engage broad based technical knowledge in emerging and least developed countries (LDCs).
- Provide support for entrepreneurs to expand their skills and networks.

Without these processes and their technological advances, broader environmental goals such as universal access to clean energy and clean water, climate stabilization and biodiversity have not been achieved; preservation will remain unattainable. The Appendix provides further insights into the gap in addressing green development in developing countries.

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