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AGRICULTURAL-DOMESTIC WASTE MANAGEMENT IN INDIA

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Abstract

India is an agriculture centered economical system, with about 70% of rural households still relying on agriculture as their primary income medium. About the fact that agro-waste is considered a non-product by-product of manufacturing, wastes can be useful and valuable to society if properly processed. To dispose of agricultural waste, they began burning it and digesting it anaerobically on the ground, resulting in air pollution and the emission of noxious and greenhouse gases. Chemical fertilizer is not only costly, but it also accumulates in vegetation, seeds, and undergoes bio-magnification, resulting in health problems. Agricultural wastes can be used to produce electricity, biofuel, bio-fertilizer, manure, biogas, and paper, among other things. The best substitute for reducing global environmental problems caused by waste dumping is sustainable resource usage. This study looked at the use of vermicomposting to treat farm waste. It also looked at the present stage of waste administration of India, its impact on municipal health and the atmosphere, and the projections for improving municipal solid waste disposal in the country.

Key words: Agricultural, Energy, Environment, Management, Recycling, Waste

Introduction

With a population of 1.21 billion people, India is the world's 2nd largest, accounting for nearly 18 percent of the global population, but it lacks the infrastructure and structures to properly handle its solid and agricultural wastes. Its urban population increased by 31.8 percent to 377 million people in the last decade which is larger than the total population of the US, the world's 3rd-largest nation by in terms of crowd[1]. Disparity between India's growing urban population and available facilities and infrastructure is stark.

People of India today are experiencing exponential economic growth, growing hopes, and increasingly evolving lifestyles, all of which are increasing public health and quality of life standards. It is also anticipated that misused equipment will be remedied and recovered. If these requirements are not fulfilled, people will experience a decline in their quality of life. Pollution of the environment, water, or land reduces production over time, resulting in a weakening of a country's economic situation. As a result, pollution reduction is a critical component of environmental growth in order to reduce the risk of ill health, protect the natural world, and improve our quality of life[2].

1.1. Agricultural Waste

Food waste, agro-waste, animal feed, horticulture, aquaculture, and other sources all contribute to agro-waste. Agriculture generates biomass about 140 billion metric tons per year worldwide, According to data provided by the Ministry of New and Renewable Energy (MNRE) in 2009, India produces around 500 metric tons of agro-waste per year[3][4]. However, there is a pressing need to reduce agro-waste and reuse it in a systematic and efficient manner, such as through bio composting, processing of mushroom, production of energy, animal silage, and other methods[5]. Waste may be converted into manure or compost or prepared of in landfills with lesser environmental effects using anaerobic and aerobic techniques[6]. Many procedures are involved with waste control, including waste generation, transportation, sorting, recycling or disposal, and waste inspection. Waste microbial technology is used to recycle and store fruits and vegetables.

1.2. Characterizing Agriculture-Waste

Domestic, agricultural, mining, and manufacturing activities have contributed to an increase in the quantity and variety of solid wastes generated as a result of population growth, urbanization, and rising living standards as a result of technological advancement (Figure 1)[7]. The different types of agriculture wastes are given below:

1.2.1. Cultivation activities

1.2.3.1. Jute-stalks or sugarcane tops:

For acoustic purposes, these byproducts are used in chipboard, soft-board, cotton, or matrices.

1.2.3.2. Wheat waste:

Straw is a by-product of the wheat crop that is used for animal food, particle-board, carpets, dried flowers, lumps, hats, and a variety of other handcrafts.

1.2.3.3. Rice hulls:

Generally utilized as the fuel or the rough oddity.

1.2.3.4. Cotton wastes:

Cotton canes are the cotton's harvest by-products. Canes are used under power plants, plywood factories, particle board factories, and composting.

1.2.3.5. Paddy waste:

Paddy husk/straw, and other by-products of the paddy crop are used to make these products. They're used for animal feed, bedding, and shelter, as well as mulching, composting, and wood.

1.2.3.6. Mustard waste:

Mustard sticks and husk are 2 major byproducts of this crop. Both of these products are sold to brick manufacturers.

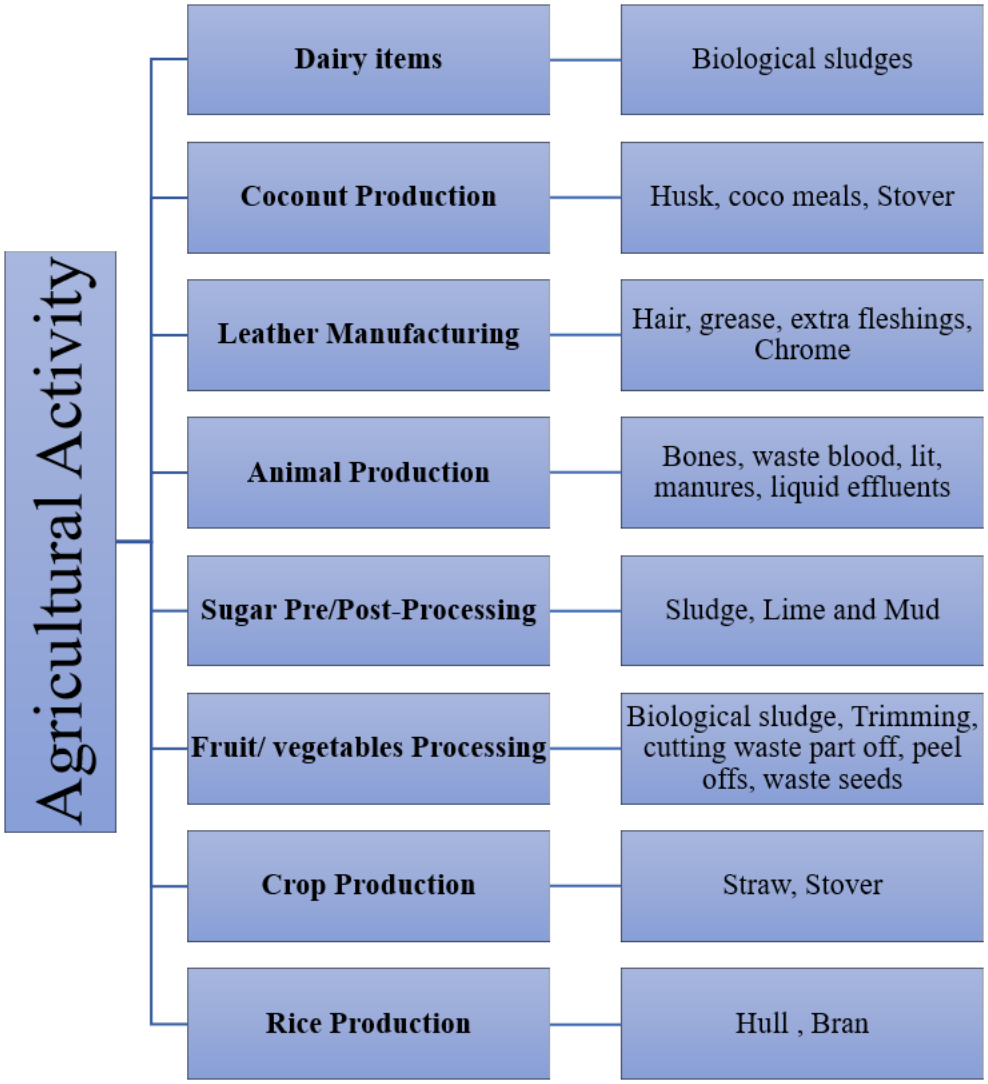

Figure 1: Agricultural Wastes Produced after Agricultural Activities Are Performed with them.

1.2.2. Production of Livestock:

Farmers utilized livestock waste for creating cow dung's cakes, which are a more efficient fuel source. Biogas, composting, and bio-insecticide are only a few of the applications.

1.2.3. Plant-waste i.e. fruit/vegetable processing

1.2.3.1. Banana stalks and leaves:

Painting and waterproofing agents are made from these by-products. Water that had been boiled with leaves and stalks of banana and combined with clay was reused as a water proofing agent. These combinations can also be used as a paint and defends against heavy rains.

1.2.3.2. Coconut production:

Coconuts have a variety of by-products, including straw, coir fiber, husks, un-retted coconut pith, coconut shell, and so on. They're recycled to make boards, fibers, wood particles, roofs, sidewalks, and mats, among other things.

1.2.3.3. Sugarcane waste:

Sugarcane litter, growing green fodder, and bagasse are among the crop's leftovers. Sugarcane leftover is recycled in the processing of ethanol and sugar.

1.2.3.4. Jute goods:

Jute-stalks are the primary byproduct of the harvest, and they're used to make soft boards, matrices, and acoustic cloth. Jute stalks were used in a few factories on a wide scale.

1.2.4. Agro-industrial waste (sugar processing):

Bagasse is produced in large quantities by the sugar industry each year and is utilized in insulation boards, wall panels, corrugating mediums and printing pages.

1.2.5. Horticulture waste:

Horticulture wastes include spoiled, unused, and destroyed vegetables/fruits, as well as roots, leaves, and dead plants [8].Typically, these wastes are composted or used as animal feed. Animal feed is made from unsold fruits and vegetables

1.3. Reuse/Recycling Technologies

The repurposing of remains, the establishment of a suitable recycling facility, and the conversion of waste into the intended end use are all part of waste utilization technologies. On the other hand, agro-waste has a well-defined life cycle. Another important goal of management is to cut down on agro-waste and recycle organic matter[9]. Agro-wastes can be found in a variety of processes and applications. Approaches from the agro-wastes that are useful [10]. About 20% of agricultural products are ruined due to bad post-harvesting system, remaining 10% are eaten by rats and all [7].

1.4. Rice-hulls:

For dumping of rice-hull, 2 rudimentary groups are demarcated below:

1.5.1. Portland cement:

Cement is made using a mixture of the insulating system value and the silica’s particles of ricehulls.

1.5.2. Water glass (sodium silicate):

In water glass’ production, rice-hulls are utilized as a resource of silica, and they undergo a total combustion process. Wet-air oxidation, also known as the Zimmerman technique, is another method of processing.

1.5.3. Porous silicate materials:

Rice hull ash with a strong sealing consistency is used to make building stones, architectural insulating slabs, and pipe lagging, as well as collective for mortar, building blocks of concrete and easy weight concrete.

1.5.4. Architectural board:

Vulcanized cellulose fiber and hull bonding, as well as a sodium silicate matrix, are used in the physio-bonding processes of rice-hulls to manufacture architectural sheets.

1.5. Products from coconut waste:

The coconut produces a considerable quantity of waste, but these wastes are used to make a large number of items.

1.6.1. Coconut husk and coir fiber:

Strong building panels, corrugated roofing sheets, and other products are made from a mixture of coir fiber, Portland cement and coconut husks. The sheets are recycled in a variety of applications, including partitions, walling, and roofing.

1.6.2. Coir-shearing waste:

Coir-fiber is recycled to make pads, and particle boards are made from a mixture of pith and dust.

1.6.3. Un-rattled coconut pith:

Waterproofing is better achieved with cashew nut glue-bonded boards. They're frequently used for auxiliary and temporary construction.

1.6.4. Coconut fiber boards:

Waterproofing is better achieved with cashew nut glue-bonded boards. They're frequently used for auxiliary and temporary construction.

1.6.5. Layered particle board:

Waterproofing is better achieved with cashew nut glue-bonded boards. They're frequently used for auxiliary and temporary construction.

1.6.6. Coconut husk and particles' boards:

Coconut's husk/particle boards which are vulnerable to termites' wood rotting fungus, which are only mildly resistant to fire. When opposed to wood, husk board is less expensive to produce.

1.6.7. Coconut shell:

Coconut's shells and urea/phenol formaldehyde glue have been used to create building boards.

1.6.8. Retted pith:

Among sidewalks, runways, and concrete slabs, coconut's pith mixed with cashew nutshells and liquid resins are recycled as fillers. It is termite, fungus, and moisture tolerant.

1.6.9. Reeds, stalks, and straw:

Dry reeds, stalks, and straw may be assembled to make a low-cost home. Straw and mortar can also be used to build walls and boards.

1.6.10. Straw-paper board:

Straits-process compresses vegetables fiber, cereal straw, and straws in pressure and heat to produce boards as well as craft paper.

1.6.11. Reed boards:

This boards are made for use in industrial building and wall construction. They are extremely durable, compact, and inexpensive.

1.6. Manure's application:

In contrast to chemical fertilizer on the ground, animal manures produce 19 percent nitrogen, 38 percent phosphorus, and 61 percent potassium. However, making fertilizer from animal manure has certain drawbacks, such as high transportation, delivery, and storage costs, odor, and groundwater pollution. When manure is added to soil, it improves fertility, nutrient retention, soil texture consistency, and water-holding capability.

1.6.1. Heavy Metals' Removal Adsorbents:

Heavy-metals, which are harmful to many life types, are produced in large amounts as a result of industrialization and urbanization. Agricultural wastes are very cost effective way to handle effluents for heavy metal adsorption. Heavy-metals have been removed from hazardous waste in the past [11][12].

1.6.2. Pyrolysis:

Agricultural waste is insulated to 400–600°C in the deficiency of oxygen in this process, resulting in char content. Agricultural waste is pyrolyzed to generate oil, low-heating-value gas, and char. Alcohol for fuel, ammonia for fertilizers, glucose for food and feed, and bio char for soil supplementation are the main goals of this process.

1.6.3. Animal feed:

Animal feed has an insufficient amount of protein sources. Some quantity of fodder, meadow with jots, and protein concerted scraps are provided to increase the feed quality.

1.6.4. Direct combustion:

Agricultural wastes are primarily used as fuels in thermal conversion processes that produce mechanical and electrical power while also including CO2 and water, such as charcoal production, steam generation, heating, and cooking. In the presence of oxygen, 95percent of converted into energy creation units (oxidation) from these wastes.

1.6.5. Composting:

The aerobic disintegration of carbon-based materials with the aid of microorganisms is what this process entails. Oxygen and moisture have the greatest effect on disintegrated organic matter. The best scale for decomposed matter is 0.5 to 1.5 inches.[13].

1.6.6. Wastes from mushroom production:

Mushrooms are grown using natural materials used in agriculture, industry, and woodlands. Mushroom waste can be used for manure, crop growing, planting, animal feed, nursery production, vermicomposting, and biogas. Soil mixtures for potting, enriching soil, contaminated water remediation, vermiculture, bioremediation, fuel, animal bedding, and feeding are just a few examples of waste uses in Agaricus bisporus production. In the Sonipat district's village of Aterna, a farmer operates a mushroom processing machine that runs on biomass energy.

1.6.7. Waste from Biogas Plants:

Manure being an essential and valuable part of biogas waste which comprises deadstock, wasted fodder, waste from milk-house, and silage run-off. This advancement has the potential to enhance agricultural residue energy discharge, plant-nutrient conservation, and rural well-being and eminence of life. Agricultural waste can be

reused in a variety of ways, but farmers are less knowledgeable of waste recycling. However, a growing number of farmers are not using agro-waste as a source of energy.

1.6.8. Vermiculture:

Garden composting with worms is known as vermiculture. Decomposition is a natural phenomenon that occurs with all organic material over time. Vermiculture, on the other hand, speeds up the operation considerably. Worm manure is an outstanding soil conditioner and natural fertilizer. Vermicomposting encourages plant growth, decreases plant disease, enhances water retention and aeration, and increases soil porosity and microbial activity. Vermicomposting is also good for the atmosphere because it reduces the need for artificial fertilizers and the volume of waste that ends up in landfills.

Vermicompost is a nutrient-rich organic fertilizer and soil conditioner that provides water-soluble nutrients in a shape that is relatively easy for plants to consume. Worm castings may be used as an agricultural fertilizer in some cases. To prepare the waste for vermicomposting, a concrete foundation is needed. Loose soil encourages worms to invade the soil, and when washing, all dissolvable nutrients are washed into the soil with the water. The partly composted waste would be added to the vermicompost bed once more. It's an organic fertilizer and compost that's high of all of the plant's important nutrients. It is completely non-toxic and pathogen-free. It increases the texture, aeration, and water retaining capability of the soil.

Since this fertilizer derives its "fuel" from the life it contains, it is critical that life be maintained even as it is stored. This basically ensures that oxygen, moisture, and temperature are kept relatively constant from the beginning. With these measures in place, “fresh” worm compost will last up to three years, if not longer. With crops ranging from strawberries to tomatoes to peppers and more, vermicompost or worm castings application results in a higher yield. Hormones that control and stimulate plant growth can be found in certain vermicompost. Vermicompost can support a healthy microbial population by including beneficial fungi and bacteria. Organic content in good soil is said to make up about 5%, but in over-farmed soil, that amount has declined to 1%. The addition of vermicompost to the soil can aid in the restoration of that balance.

Biomass:

Dedicated energy crops, farm residues of the crops, timber residues, algae, wood processing residues, municipal waste, and wet waste are all examples of biomass feedstock’s (forest scraps, industrial wastes, crop-wastes, algae, woody energy crops, urban wood-waste, purpose-grown grasses, sorted MSW, and food-waste). On existing lands, there are many options for using agricultural resources without interfering with food, meat, fiber, or forest product processing. Agricultural crop residues, such as leaves and stalks, are plentiful, diverse, and widespread. Land biomass feed-stocks (such as leaves, discarded trees and tree parts that would be unmarketable) and whole tree’s bio-mass reaped solely for bio-mass are two types of forest residues left over from harvesting. Following timber collection, dead/diseased, badly constructed, and unmarketable trees are often left in the forests. Byproducts and waste streams from wood production are referred to as wood processing remains, and they have considerable verve capacity. Yard trimmings, paper and food wastes, paperboard, rubber, plastics, leather, and textiles as well as mixed industrial and residential garbage, are all included in MSW facilities. Organic-rich bio-solids (i.e. treated sewage sludge from urban wastewater); manure slurries from concentrated livestock operations; commercial, industrial, and residential food wastes (especially those which are now predisposed of in land fillings).

Few useful recommendations that can be implemented are as follows.

- A range of methods, extending from centralized waste collection and recycling to reorganized devices that work on a neighborhood or household level, may be used to repurpose and treat waste as a resource. Soil additives, bio fuels, and industrial raw materials can all be made from agricultural waste.
- Re-carbonization of soils or flora in India will have a number of benefits, including improving agroecosystem stability in the face of changing and unpredictable environmental conditions, justifying climate changes through soil-carbon confiscation, advancing food and nutritious sustainability, biodiversity being

improving, and water supplies being improved, and assuaging scarceness through generating employment also motivating unfortunate populations.

- Flying ash particles can be used as a secondary raw material in building and mine filling, as well as in higher-value applications including concrete additives, by power plants. Prescriptive specifications will be replaced by performance-based criteria.
- Liquid fuel processing and road building are two potential uses for plastic waste; waste to energy ignition is the only choice. Government help is going to be benefiting while addressing the financial obstacles to processing, segregation, and transportation.
- India's top manufacturing companies are now looking at means to recycle and re-use waste-material. In demand to achieve a cost effective full circle budget, businesses have a lot of ways to collaborate with manufacturers, consumers, and companies from other industries.
- To maintain the protection of ecosystems and provide essential resources, municipality cities and businesses should show consideration in their land usage policies. Protecting soil quality, in particular, is critical for both agricultures based production and SOC confiscation.
- In designed Innovations and communication, ranging from trash recycling for the usage of toilets in place of openly excretion, are needed to evoke behavior change. Because of the significant differences between rural villagers and city dwellers, tailored strategies are needed.
- Power generation from agro-waste is a new environmentally friendly resource for long-term sustainability because it emits less pollution than traditional energy sources (coal), and it will eventually meet global energy demand. When organic wastes are broken down by microbes in a heat-generating system, the amount of waste is reduced, and goods are generated, improper agro-waste disposal not only pollutes the environment but also wastes a lot of valuable biomass resources.
- Keep people aware of the world around them, such as a dirty river, air, and soil. Attentiveness of emerging initiatives that have an effect on the climate. Avoid burning wastes in particular. Concerning the informal agricultural waste-management practices and their connections. Data on product's reprocessing, promotion, also delivery.
- Waste has its own scheme, as well as adequate collection, transportation, and recycling. Plastic bags must be avoided. Encourage people to start composting their organic waste in a vermiculture bin. By reducing agro-waste, a safe and fresh atmosphere can be developed.

Given the size and diversity of the Indian economy, the above proposals constitute an ambitious agenda. And if new laws and guidelines are implemented, enforcing them would be difficult. As a result, encouraging cooperative compliance and creativity would be crucial to the potential sustainability of circular economy and sustainable materials management systems. With a bit of luck, this is going to coordinate policies that will reduce waste production and its reusability to sustain back Indian economy.

We do use simple waste disposal practices in India, such as dumping waste into a septic tank, open land, burning, and so on. Agro-wastes are the leftovers from seed processing, such as leaves, stems, and other plant parts. These wastes are high in scale and have no protein or fat. Waste-generating crops examples are sugarcane mustard, wheat, bagasse, tea, paddy, vegetable waste, food items, cotton stalk, groundnut shell, coconut husk etc. About 20percent of agro-products are spoiled due to bad post harvesting facilities, and 10perrcent are consumed by rodents present in that area [7].

Currently, both big and small private sector companies in India are implementing waste prevention and recovery projects. The following are some examples[14]:

- The Tata Group's sustainability agenda and productivity benchmarks cover power conservation, zero waste, recycled products, and products stewardshiping. Tata Power's efforts to promote the use of flying ashes from thermal coal-fired power plants, which comprises reprocess by Tata Motors to construct compound materials, are an example of a circular economy project.
- The Mahindra Group is working on increasing renewable sales by using environmentally friendly deeds Foundry sand is recycled for making brick and block, food waste is processed in bio gas, and school benches are constructed from wooden packaging waste. To reach 0 waste to land fill at a city level, they change

organic waste into compacted natural gas(CNG), which fuels several vehicles and electricity grids.

- Alternative Fuels and Products (AFR) are distributed by ACC Cement to substitute renewable mineral supplies and fossil fuels with environmentally friendly cement made from waste. In India, over 90 studies have been conducted to show that AFR co-processing has no negative effects on cement plants releases or product excellence.
- Bharco Eco Technologies has advanced a waste to energy system that doesn't need ignition and involves flotation and isolation of urban mixed waste in water. Tarragon has developed a lightweight, self-powered system that transforms flammable waste into syngas and a small amount of bio-char residue.
- Life Connections uses soil biotechnology to minimize nitrogen emissions, and their decentralized approach is cost-effective, low-energy, and pollution-free. With only green biomass, bio-mineral fertilizer, and soil as byproducts, this approach, which is focused on a combination of ecology and engineering, can achieve treatment rates much higher than natural soil-plant schemes.
- Keshava Plastics, based in Pune, operates a plastic-to-fuel facility that shreds all forms of plastic waste from over 15 thousand offices, households and hotels. Using insulation and a catalyst, waste is turned into liquefied fuel and clean synthetized gas.
- The Indian Pollution Control Association, with the aid of the waste picker society, provides waste recycling services to residential, commercial, and institutional campuses in Indian cities. The program's goal is to isolate waste materials and send them to the appropriate recycling sectors while also ensuring that waste pickers are treated with respect and reasonably paid.

Discussion

Least environmental changes and maximized protection with near to zero risk should be the only aspect institutionalized by any of the waste management processes. Agriculture wastes are the remnants of crop harvesting, which include leaves, wood, and other materials. These wastes are bigger and have fewer protein and fat in them. Vegetable waste, wheat, sugarcane, wooden mill waste, mustard, paddy, food products, cotton stalk, groundnut shell, jute fiber, coconut husk, bagasse, tea, and other waste-generating crops are examples.

Many current waste sources are under-utilized; for example, MSW poses significant resource because This combines about 85% biomass along with few other inflammable materials to create a blend of energy dense fuels. Similarly, coal combustion residues from power plants, such as fly ash, bottom ash, boiler slag, and flue gas desulfurization residues, can be used to make concrete, gypsum wallboard, construction materials, surface stabilization tangible and structural fills.

Conclusion

There is a tremendous opportunity for companies to come forward and recover agro-waste and manufacture valuable materials from waste. We will usher in a new era focused on proper waste management with the aid of certain laboratory techniques, research, and technology. Many growers are still unaware of how to make use of agro-based wastes, how to make use of Some farmers are knowledgeable about waste reuse and management. Some policies have been implemented to minimize waste, raise revenue, and create jobs in order to manage such waste products. Forest as well as agricultural wastes are used in bioenergy and industrial biotechnology, as well as for soil fertility. With the provision of Non-Governmental Organizations, private companies are developing attentive strategies for recognizing and awakening agro-waste uses and recycling as a valuable product. This waste material is utilized as a raw material in manufacturing, heat engineering, along with industrial systems. Policy changes needs to promote technologically advanced innovation and waste-management innovations in order to step closer to a circular economy. Indian companies and societies have shown that borrowing global best practices and tried-and-true solutions will benefit public health, sanitation, power access, water and land protection, as well as save money. The holistic structure proposed in this paper will help explain the threats, chances, and incentives related with numerous public, ecological, and industrialized ingenuities.

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