CONVERTING PINEAPPLE PLANT RESIDUES INTO TEXTILE FIBRE AND COMPOST IN KENYA

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Mananasi Fibre Limited is a start-up company established in Kenya, that offers a range of sustainable products that up-cycle the entirety of the discarded pineapple plant. In particular Mananasi offers fibers with unbleached whiteness and minimal impurities for textile projects, while their compost supports healthier soil and organically enhanced yields.

The company was established in 2022, in partnership with The Chequered Flag, with the intention of developing a sustainable waste management strategy for pineapple plantations. Supported by funding from the Sustainable Manufacturing and Environmental Pollution (SMEP) Programme, the company began its operations near Thika, Kenya, in July 2023, utilising pineapple plant waste generated by the Del Monte plantation. Mananasi Fibre Limited's company is aimed to demonstrate an environmentally, socially, and financially viable strategy by converting waste into textile-grade fibres and soil-enhancing biochar. This approach not only addresses the environmental issues associated with open burning but also leverages the biomass for productive use. The company intends to benefit the local community by providing a sustainable solution for waste management while contributing to soil health and supporting the local economy.

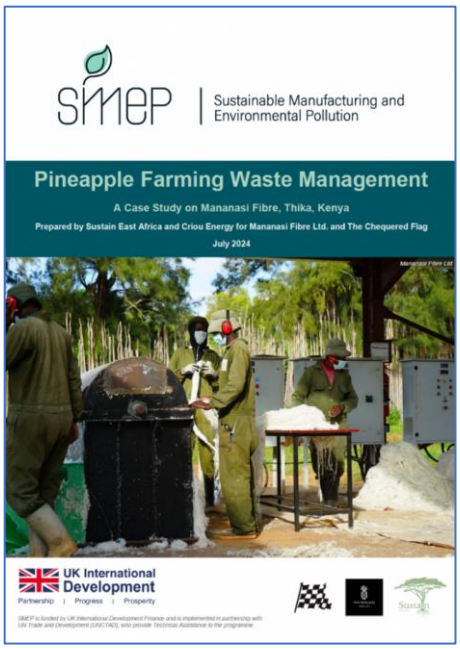
Their process starts by carefully selecting the ideal leaves for fiber production and utilizing cutting-edge decortication technology. The fibers are then sun-dried, refined, and packed, ready for export to the textile industry. Meanwhile, the rest of the plant waste undergoes composting, creating a valuable resource and returning vital nutrients to the fields.

The products of this process are the following:

- *Pineapple fibre natural.* Raw Fibre is a versatile material suitable for a wide range of applications. It can be utilised in textiles crafts, packaging, papermaking, and more. It is decorticated, washed, dried and baled with an impurity and water content less than 1% and 15% respectively.
- *Pineapple fibre brushed.* Raw Fibres undergo a softening and disentangling process, resulting in a beautifully refined material. They can be used in various applications, including textile production, where its fine texture adds a unique touch to clothing, accessories, and home furnishings.
- *Organic compost.* The remaining parts of the plant (leaf pulp, roots and stems) are decomposed through a technique known as aerated static pile composting. The compost is ideal for both agricultural and garden use where it can be used as a substitute for synthetic fertilisers.

At the Mananasi Fibre Company, they use a cutting-edge decorticator technology, developed in-house to tackle the challenge of pineapple plant waste. Their innovative machinery extracts fibers from the waste, providing a sustainable solution for textile production and sustainable agriculture. They have designed and built an advanced decorticator that sets new standards for waste processing efficiency. The technology has proven successful in their own operations, and it will soon be available to other pineapple plantations seeking effective waste management solutions.

By harnessing the decorticator technology, pineapple plantations can transform their waste into valuable resources, reducing environmental impact and promoting sustainability. The versatility of their machinery enables the extraction of high-quality fibers that can be used in various textile applications. Continuing their commitment to innovation, they are also developing a mobile harvester to increase the efficiency in recovering plant waste from the field. Through automation, they aim to streamline operations and reduce labor-intensive tasks, empowering pineapple plantations with advanced tools for waste management.



The case study on Mananasi Fibre published in 2024, prepared by Sustain East Africa and Criou Energy for Mananasi Fibre Ltd. and The Chequered Flag. provides an overview of the global pineapple fibre extraction industry and market as well as an overview of the pineapple waste management solutions implemented by Mananasi, which include fibre extraction, biochar and bio-compost manufacture. The current practice at the Del Monte plantation, like many pineapple producers around the world, is to rotate their pineapple crops every three and a half years. After the final harvest, the spent plants are knocked to the ground and left to dry before being burnt. The waste material amounts to approximately 40,000 tons of dry matter per year which, when burnt, emits approximately 52,000 tons of CO2, 2,800 kg of NO2, along with other noxious gases that pollute the atmosphere.

The Del Monte plantation is located on the outskirts of Nairobi where its boundaries are densely populated. The smoke produced from the pineapple waste fires drifts into these in-habited areas where the fine particulate and other products of combustion can cause a range of health problems. To increase soil fertility, Del Monte uses mineral fertilizers to restore nutrients in the soil. However, these fertilizers do not replenish the organic matter or the microbiome essential for soil health. Additionally, mineral fertilizers have a large carbon footprint, both in their manufacture and application. The current practice of burning plant waste is also inefficient for crop rotation. Del Monte must wait until the plant waste has completely dried in the sun before incineration, a process that can take up to six months depending on the weather, delaying planting and reducing productivity. The waste management solutions address these issues by intercepting the plant waste to produce textile-grade fibres, biochar and organic compost.

The pineapple (Ananas comosus) is a tropical fruit cultivated worldwide, primarily in tropical and subtropical regions. Originating in South America, the fruit was first cultivated in Central America, Brazil, Paraguay, the Caribbean, and Mexico. Today, pineapple production has expanded globally, with major contributions from Asia, Latin America, and Africa. The global pineapple industry has seen notable growth and development in recent years. The market is projected to grow at an annual rate of 2%, with total production expected to reach 37 million metric tons by 2030. As of 2024, the global pineapple market is valued at approximately USD$ 28.79 billion and is projected to grow to USD $39.13 billion by 2029, with a compound annual growth rate (CAGR) of 6.33%. This growth is driven by expanding harvested areas and increasing demand, particularly in Asia and the Americas.

PINEAPPLE FIBER

The fibre extraction process, which forms the financial backbone of the project due to the high value of pineapple fibre, is currently underway and critical to the project's overall success. The ongoing activities include:

- *Plant Harvest*: Immediately after the final fruit harvest, workers uproot the plants by hand in the field and load them into trailers for transport to a central processing facility. Leaves over 600 mm in length, suitable for fibre production, are selected and cut them from the plants.
- *Decortication:* This fundamental process separates the fibres from the rest of the plant. The leaves are automatically transported through the decorticator machine by conveyor, where spinning rotors scrape the flesh from the fibre with the help of cleaning water.
- *Drying:* The extracted fibre is taken to a nearby drying ground, where it is spread out to dry in the sun.
- *Brushing:* This involves hand-feeding the fibre into a machine with a spinning rotor and combs, softening and disentangling the individual fibres, thereby enhancing the quality of the fibre.
- *Baling:* The fibre is packed into 100 kg bales using a hydraulic press. These bales are then stored in a dry, well-covered shed, ready for packing into containers and export
- *Sale:* The fibre is exported via containers to markets in Europe and South-East Asia.

BIOCHAR AND BIOCOMPOST

The creation of biochar and biocompost starts with the processing of the effluent from the decorticator and includes the following activities:

- *Moisture Removal with Hydraulic Press:* The first significant step in the process is removing moisture from the effluent using a hydraulic press.
- *Drying and Pyrolysis to Create Biochar:* Once the wet cake is prepared, the next stage involves drying and pyrolysis to transform the dry waste into biochar.
- *Carbon market and local compost sale:* The biochar credits are sold on the international market, and bio-compost is also sold locally.

The farm employs 69 full-time staff, providing important income opportunities, especially for youth and women. Seventy-five per cent of workers are aged 35 or younger and are therefore classified as youth. Employment on the farm has provided important income-earning opportunities for those who were previously unemployed without any income (31%), and those who were previously underemployed (26%).

The project has successfully developed four iterations of the decortication machines. To date more than 1,500 tonnes of pineapple waste has been diverted from the Del Monte pineapple fields, and over 40 tonnes of pineapple fibre have been produced. The project site has incorporated the use of renewable energy through the installation of solar panels and a rainwater harvesting system. Mananasi Fibre provides significant socio-economic benefits by creating jobs and reducing poverty. The project has the potential to enhance farm productivity and sustainability through biochar application.

If 70% of the Del Monte plantation in Kenya were harvested, approximately 2,000 jobs could be created, injecting over $3 million into the local economy. This would benefit an additional 6,000 dependents and significantly boost the regional economy. The work to identify the potential for this project to have a significant impact appears to have yielded good results. In fact, in 2025 a news report appeared in many newspaper in Kenya informing that the Competition Authority of Kenya has approved the proposed acquisition of 100% of the shares in

Mananasi Fibre Limited by Del Monte Kenya Limited.

The Mananasi Company and the project for Pineapple waste management have been supported by the Sustainable Manufacturing and Environmental Pollution (SMEP) Programme. The SMEP Programme is funded by UK International Development (UK Government) and implemented in partnership with the United Nations Conference on Trade and Development (UNCTAD), which provides technical support.

To know more

Mananasi Fibre Company website

Mananasi Fibre website -about us

The Case study on Mananasi Fibre 2024

Mananasi Fibre in Sustainable Manufacturing and Environmental Pollution (SMEP) Programme

The chequered-flag in smepprogramme.org

Article in talkafrica.co.ke

Article in Kenyanwallstreet.com

Article in cak.go.ke

Article in unctad.org