

CIRCULAR ECONOMY BUSINESS CASE STUDIES IN SOUTHEAST ASIA



Carafoods

- Nha Trang, Vietnam
- Food processing
- www.unienzyme.vn
- Analysis period: 2020-2023

Circular Economy of Tropical Fruits

Business Spotlight

Carafoods is the start-up created by Mrs. Nguyen Thu Hong, who is pioneering the production of products based on fruit enzymes along with other fruit-based products in the Khanh Hoa province of Vietnam. The purpose of Carafoods extends beyond fruit export. The company's mission embraces circular economy model for tropical fruit production, where every value is derived from every part of the fruit. Fruit enzymes and other fruit-based products produced by Carafoods, including organic shampoo, skin products, detergent and fertiliser are connected with a healthful lifestyle, and their production provides an additional source of income for farmers growing mangoes, green pomelos and oranges. Carafoods produces the fruit enzymes at much lower prices than it would cost to import them. The production at Carafoods is illustrative of the circular economy where both the edible and inedible parts of tropical fruits are used for making new, and high value-added products.

Keywords

Fruit enzyme, Fruit waste

Innovation

Manufacturing, End-of-life management, Resource circularity, Resource substitution



Analysis of Carafoods

Context and baseline

Vietnam's diverse climatic zones and suitable agronomic conditions have enabled the country to become a major producer of a variety of tropical fruits. The tropical fruits sector is witnessing substantial development and has become a significant contributor to local GDP and export earnings. According to the Vietnam Ministry of Agriculture and Rural Development, in 2023 the export value for vegetables and fruits reached US\$ 5.69 billion, a 69% increase compared to 2022. Development and growth of the sector has a high multiplier effect on the local economies, contributing significantly to employment and household incomes. While there have been some successful entries into selected export markets, competition in global markets is strong, particularly since most fruits and vegetables are exported fresh and are thus vulnerable to lower on the spot prices during the peak season when supply is high. As a result, many Vietnamese farms suffer losses because of low prices for mango, orange and pomelo. This price instability disproportionately affects small producers, with market prices at times falling below production costs. As a result, many tropical fruits are thrown away or dumped every year, wasting high-quality food and causing economic and environmental damage. Improving the value of this produce with novel products and lowering the price vulnerability of the fruit sector will help the country get a better return for investment in tropical fruits and vegetables and also improve farmers' livelihoods.

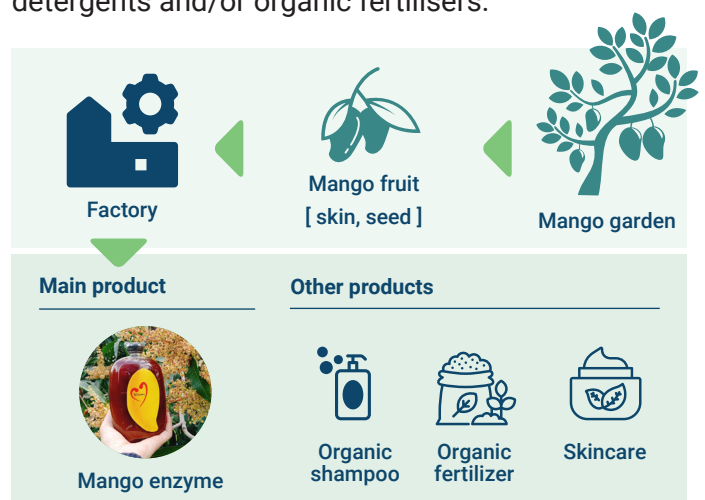
Mrs. Hong, an ethical entrepreneur who founded Carafoods, envisions a sustainable future that connects people, the environment and the economy. The journey of Carafoods began during her studies in Japan, when she realised the severe negative social and environmental impact of the food processing industry, which encouraged her to look for new ways to sustainably develop the fruit sector. She was spurred to research a sustainable alternative. Inspired by the abundance of agricultural products including the tropical fruits in Vietnam, and the benefits of circular economy business models, Mrs. Hong sought to create healthy products originating from tropical fruits. This created fruit enzyme drinks and fruit-based products including skincare products, organic shampoos, detergents, and organic fertiliser. These can all be commercially produced, encourage positive social and economic actions and have a low environmental footprint. She developed a unique enzyme drink made with Vietnamese fruits such as mango, dragon fruit and green pomelo, applying knowledge from the traditional and waste-free production practices already established in Japan.

Innovation

Carafoods pioneered using all the parts of tropical fruit in production of valuable products.

Production of fruit enzyme from tropical fruit: This circular innovation is based on the customised application of Japanese food processing knowledge and traditional Vietnamese fermentation techniques in fruit processing to produce valuable enzymes. Fruit enzyme is the result of the valorisation of fruit (both the edible parts and the skin) and the use of other fruits and renewable materials as the main components in the final product. Enzymes are biological substances of complex protein molecules that catalyse specific biochemical processes in the body and indeed in all living organisms. They are crucial for metabolism and food digestion. Consumption of these enzymes is credited with improving human health, and producing them promotes the environmentally sound utilisation of the entire fruit including the waste, and, in the process, the livelihoods of local farmers improve. Since the initial discovery, Carafoods has launched a series of fruit-based enzyme products such as fruit enzyme drinks and dried fruit enzymes.

Tropical fruit by-product utilisation: Fruit production generates large quantities of fruit by-products such as peels and seeds, which are routinely discarded from the production process. However, these by-products still contain high levels of bioactive compounds with relevant chemical and nutritional value, mainly pectin, proteins, antioxidants and phenolic compounds, which are generally considered as beneficial in maintaining good health. Furthermore, these by-products are rich sources of complex polysaccharides, carbohydrates, fibre and vitamins. Carafoods utilises tropical fruit by-product including peels and seeds for making new products. Since mid-2021, by-products and waste have become the material source for skincare products, shampoos, detergents and/or organic fertilisers.



Circular Economy impact

The innovations at Carafoods contribute to the circular economy mainly through circular use and reuse of natural resources, generally known as resource circularity, and replacement of non-renewable materials with renewables, generally known as resource substitution.

Resource circularity is achieved by using all parts of tropical fruits (edible and non-edible parts and by-products) as ingredients in fruit-enzyme-based and related fruit-based products. Using the non-edible parts prevents them from entering waste streams for composting or worse, being put into landfill. For example, mango processing produces significant quantities of by-products, mostly peels and seeds representing some 24% and 40% of fresh fruit weight, respectively. The waste thus generated not only carries environmental risks but also represents a significant loss of nutrients and other bioactive materials. Putting tropical fruit by-products into useful new products not only minimises waste and the associated pollution, but also provides them with commercial value.

Carafoods is also looking for the best way to utilise fruit waste. It is usable not only as compost but also as a component in various high-quality products, for example, fruit dipping sauce with an umami taste or cosmetics products, which in turn generate economic benefits for the company. Waste is valorised and the carbon footprint is reduced. The research team at Carafoods in collaboration with its partners is continuously looking for ways to improve the sustainability of the production process and developing new products with even less impact on the environment.

Resource efficiency is achieved in tropical fruit plantation, through the efficient use of organic fertilisers made from tropical fruit by-products.

Business and market impact

Between 2021 and 2023, Carafoods maintained consistent growth, with year-on-year increases of the customer base by approximately 20%. The enzyme drinks sold on the Vietnamese market are priced at VND 370,000–390,000 (about EUR 13) per litre, which is 7–8 times lower than imported alternatives. As the production of 1 litre of mango enzyme juice consumes 3 kg of fresh mango, and the cost per kilo of fresh mango is VND 10,000–15,000, the enzyme juice increases the value of the fruit by a factor close to 10. Other produce such as dragon fruit, green pomelo, orange, pineapple, and others provide similar opportunities for value addition.

Carafoods is the only company in Vietnam capable of making fruit enzyme since the product requires state-of-the-art technology. Recently Carafoods invested in equipment and a facility to increase production to an industrial scale. In early 2024 Carafoods was in the process of scaling up production while maintaining high-quality standards and ensuring positive social, economic and environmental impacts.



Stakeholders

Carafoods's circular innovation is beneficial not only to the company but for the stakeholders as well. Carafoods buys mango, dragon fruit, green-skin pomelo and other tropical fruits and vegetables from farmers at prices that are 3–4 times higher than the market price. In 2023 Carafoods procured 20 tonnes of mango, 50 tonnes of dragon fruit and 10 tonnes of green-skin pomelo as production input. Local development is thus supported via jobs provided and secure income for the fruit farmers, and this in turn solidifies the added value for fruit sector.

Popular among environment- and health-conscious customers, fruit enzyme drinks contain probiotics, antioxidants, and enzymes that are credited with improving health and regulating body acidity levels. Carafoods also advises customers on correct ways to use the fruit enzymes.

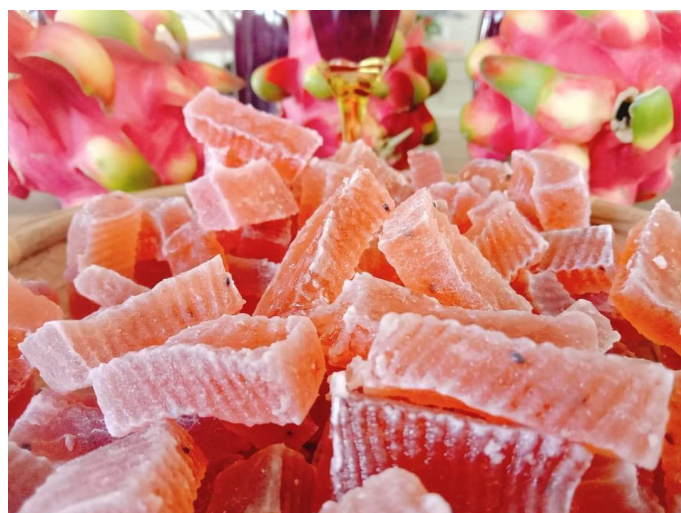
Carafoods has attracted considerable attention from market participants, suppliers and investors. The company was able to start production after attracting crowd funding of USD 250,000 from 123 private investors in 2020.

Implementation

Even though the idea of applying the circular economy model to the production of fruit enzyme-based and related fruit-based products began in 2013, in-depth production research started only in 2020. Carafoods launched the internet-based crowdfunding group 'Love Vietnam' to fund its ventures. Contributions were received against the promise of receiving the

fruit enzyme-based and related fruit-based products produced by Carafoods. The crowdfunders thus served as the company's first buyers. About USD 250,000 was attracted within two weeks, which made it possible to start production in a 4 m² workshop. From there the company expanded and opened its current factory with total working place of 6000 m².

With the economic potential of the fruit enzyme-based drinks and related fruit-based products confirmed, the challenge became one of creating market demand. The products have yet to gain widespread recognition in Vietnam, as so far consumer interest for the products remained limited. To overcome these barriers, several actions have been implemented by Carafoods, including: raising public awareness on the benefits of fruit enzyme-based and related fruit-based products; enhancing R&D activities; trust-building via communication with and among companies and stakeholders and consumers about circular economy solutions.



Takeaways

- Making novel fruit enzyme-based and related fruit-based products can add value to the fresh tropical fruit sector which can then sustainably increase the profitability of this sector, and improve farmers' livelihoods.
- Establishing a market demand for the novel enzyme-based products remains the key challenge for ensuring recognition and business success.
- Long-term commitment by the company's top leaders to go green is the key for an effective circular economy transition.



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Disclaimer

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