

# Waste valorization in the cocoa/chocolate value chain in Switzerland

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The cocoa pod husks and pulp are wasted on the farms in developing countries, and bean shells discarded in Swiss factories find low-value applications. These byproducts constitute 70 to 80% of the entire cocoa fruit. However, these underutilized materials possess potential for innovative uses. Promoting a circular bioeconomy by valorizing them is becoming crucial to addressing economic, social, and environmental issues in the sustainability of the cocoa value chain.

## Introduction and Objectives

The global cocoa beans market, with a production of around five million tonnes per year, was valued at CHF 14300 million in 2023 and is projected to grow at an annual rate of over 7%. However, most of the cocoa fruit—the pod husk, pulp, and bean shells (Figure 1)—is still discarded or used for low-value applications. It is imperative to provide immediate support to farmers to enhance their revenue while minimizing environmental impact. Previous studies have investigated various potential applications for cocoa byproducts, including their use as fertilizers, animal feed, biofuels, food, beverages, adsorbents, pharmaceuticals, and cosmetic products. The aim of this thesis is to understand the current state of waste generation and management practices within the cocoa value chain and to identify the challenges that need to be addressed to effectively integrate the valorization of these byproducts.

## Research Design

A comprehensive literature review was conducted to examine the structure of the cocoa value chain, market dynamics, sustainability, and byproduct valorization opportunities. Then, a qualitative research approach was employed, involving surveys and ten interviews with chocolate manufacturers, other companies specializing in cocoa byproduct valorization, and industry experts. A qualitative data management software was used for coding and analysis of the interviews.

## Results

Although there are already some applications of the pod husk and the bean shell being carried out, the primary byproduct currently being valorized by companies is the pulp, mainly in the food and beverage industry. The main drivers for valorization are sustainability and economic incentives. However, some major challenges include low market awareness and demand, poor infrastructure in farming regions

(where many farms lack organization and accessibility), and regulatory hurdles (such as restrictions in the use of cocoa pod husk in the food industry). The cocoa industry is characterized by fragmented value chains, which hinder the integration of circular practices. Big actors in the cocoa industry are too risk-averse to engage in this activity, leaving the initiative mostly to researchers and start-ups.

## Implications and Recommendations

The potential for valorizing cocoa byproducts is significant, but there is a need to raise awareness about the existence of cocoa fruit resources beyond the beans and to highlight the benefits of consuming products made from these resources. Major industry players must begin pushing them into the mainstream market. Also, there should be efforts to improve infrastructure in farming regions to facilitate the scaling of valorization initiatives. Productively upcycling cocoa byproducts and integrating them into existing supply chains requires cooperation by all the stakeholders.



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Figure 1: Main parts of the cocoa fruit