

Cradle to gate life cycle analysis of a leading local chocolate manufacturing industry

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Cocoa is a minor export agricultural crop currently cultivated in Sri Lanka since the British colonial period. It is one of the most valuable crops among other plantation crops. The use of cocoa fruits and seeds in food industry is common in many parts of the world. When the market value is considered, the important cocoa varieties are Criollo, forastero and Trinitario. The products that can be made from cocoa include soft drinks, alcohol, jam and marmalade, cocoa butter for making chocolate, cocoa powder and cocoa liquor. Many cocoa products are available in Sri Lankan market too. Cocoa products are highly attractive and customers are always willing to pay more for the best cocoa. The greenhouse gas emissions and generation of waste water and solid waste are very high in chocolate related industries. This paper is aimed at providing a comprehensive picture of the environmental impacts associated with chocolate manufacturing and processing industry, by applying life cycle assessment (LCA) methodology. The analysis considered the entire system required to produce 1 kg of dry cocoa beans and 1 kg of pure chocolate as the functional units. It included the agricultural inputs in cocoa production, all agricultural operations in the field and transportation. Processing and all other related process steps in chocolate manufacturing were taken in to account. The required data were collected in the factory to calculate the total emissions and waste generated per functional unit and to gain values for eleven environmental attributes, i.e., carcinogens, respiratory organics, respiratory inorganics, climate change, radiation, ozone layer, ecotoxicity, acidification/eutrophication, land use, minerals and fossil fuels. The data were analysed Sima pro 8 software. The comparison between the manual calculations and the Sima Pro 8 software results was carried out and the main factors which contribute to the most environment impacts were identified. The study was conducted in accordance with the international ISO procedural framework for performing LCA in the ISO 14040-14044 series fulfilling its main four steps, namely goal definition and scope, Inventory analysis, Impact assessment and interpretation. The overall environmental impacts resulting from Chocolate manufacturing and processing activities and improvement options towards the sustainability of the system studied are presented and discussed.

Keywords: Cocoa, chocolate manufacturing, environmental impacts, export agriculture, life cycle analysis