Master’s Thesis

## Comparative LCA study of Lettuce production in Open field and Greenhouses: A cradle to Gate approach in Germany

## Background

Germany was the largest global importer of lettuce in 2021 trading mainly with Spain, Italy, and Netherlands. Therefore, expanding sustainable lettuce production to provide the country’s demand is of paramount importance. The most conventional ways of agricultural practices to produce lettuce are Open field farming and greenhouses. Therefore, assessing the environmental impacts of these agricultural methods is necessary to promote the production of lettuce in a more sustainable manner. Life Cycle Assessment (LCA) is a widely accepted approach to quantify the hazardous impacts of products and services on the environment, human health, and resource scarcity. LCA can improve the environmental performance of products at various stages of their life cycle, and thereby aid in decision-making, marketing, and communication efforts. When LCA is implemented for food production method, it can result in more environmentally friendly and less resource/energy intensive food supply chain where all the input/output flows and emissions will be scrutinized over the product’s life cycle.

## Goals

In this master thesis, the ‘**Cradle to Gate**’ system boundary will be implemented to the **supply chain of lettuce** in **open field** and **greenhouse** to evaluate the life cycle stages of lettuce production, from raw materials extraction up to the distribution of the final product. Therefore,

the environmental hotspots and potential environmental improvements will be identified. Accordingly, two models will be developed for greenhouses and open field farming where all Life Cycle Inventory will be collected and classified for further analysis. Afterward, Open LCA software is used to evaluate the environmental impacts on the relevant environmental damage categories to compare the existing tradeoffs between these farming methods.

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