Using Food Waste to Reduce Food Waste | Evaluating the Impacts of Sourcing Food Waste as a Raw Material for Production

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Background

Circular Economy: A Solution to Extraction

Most product cycles follow a linear process, in which resources are extracted, a product is made, and then the product is ultimately discarded. Circular economy suggests that the environmental impact of a product may be reduced by using wastes as inputs instead of virgin material. While businesses have embraced circular economy, it is not always clear if redesigning supply chains this way results in a net reduction of environmental impacts.
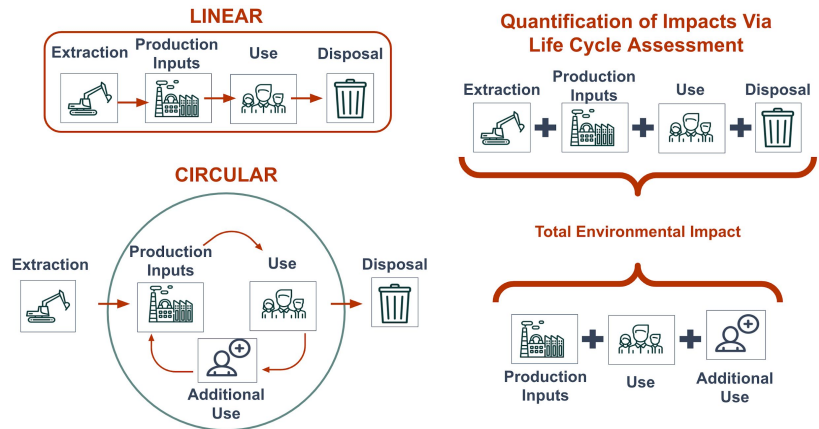
Evaluating supply chains using Life Cycle Assessment

Life Cycle Assessment (LCA) is a tool used to calculate a product's environmental impact by quantifying all of the environmental impacts caused by its creation, use, and disposal. Multiple LCA methodologies exist, with different underlying assumptions and degree of comprehensiveness. Businesses often have limited access to data and tools to analyze their supply chains, and may not be able to utilize the best method. This presents a problem because using one method over another may not capture all the environmental impacts of a particular scenario.

Key Findings and Recommendations

Key Findings

Materials thought of as wastes may have alternative uses
A business may cause unintended environmental impacts by sourcing materials not destined for the landfill.

Choice of method affects the decision outcome
Different LCA methods may result in different recommendations. Additionally, different alternative uses considered may change the final recommendation.

Recommendations

Use substitution methodology in cases where a waste could also be used by another industry
This helps capture the negative environmental impacts which may occur in other supply chains as a result of sourcing decisions.

Identify specific sources of materials, not just the material itself
Businesses should identify specifics for each waste of interest, including what it would alternatively be used for.

OBJECTIVE 1: Develop Circular Sourcing Scenarios

Identify the process through which a particular waste is created, its method of disposal, and any alternative uses.

OBJECTIVE 2: Test Differing LCA Methods

Calculate the environmental impacts of sourcing a waste using differing LCA methods to assess how the results differ.

OBJECTIVE 3: Identify Key Parameters

Conduct scenario analyses to identify how key parameters affect the calculated results.

Case Study: Apeel Sciences

Apeel Sciences is a biotech startup with a strong environmental mission. Their product is a plant based, edible coating that extends the shelf-life of produce. Apeel identified an opportunity to source industrial food waste as an input to their product, thereby creating a more circular supply chain.

Oxygen stays outside

O_2

H_2O

Moisture stays inside
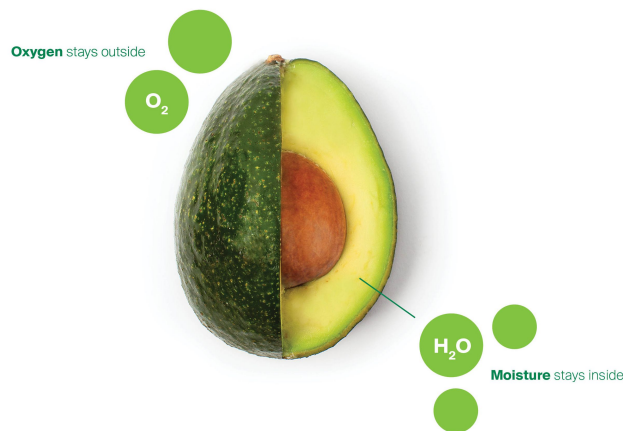
To achieve our objectives, we analyzed food wastes from which Apeel could create their product, and distilled findings from our analyses into a generalized framework and tool.

Approach

Understanding origins of wastes

We selected 4 representative wastes to investigate in detail:

- Grape Pomace
- Olive Pomace
- Coffee Cherries
- Cocoa Husks

Collect quantitative data

To quantify the environmental burden of each selected waste, we started by collecting existing LCA data on the supply chains that produce these wastes: wine, olive oil, chocolate and coffee. We then used two methods to quantify environmental impacts:

Economic Allocation

How it works: Divide the environmental burden of the supply chain between multiple outputs based on each output's market price
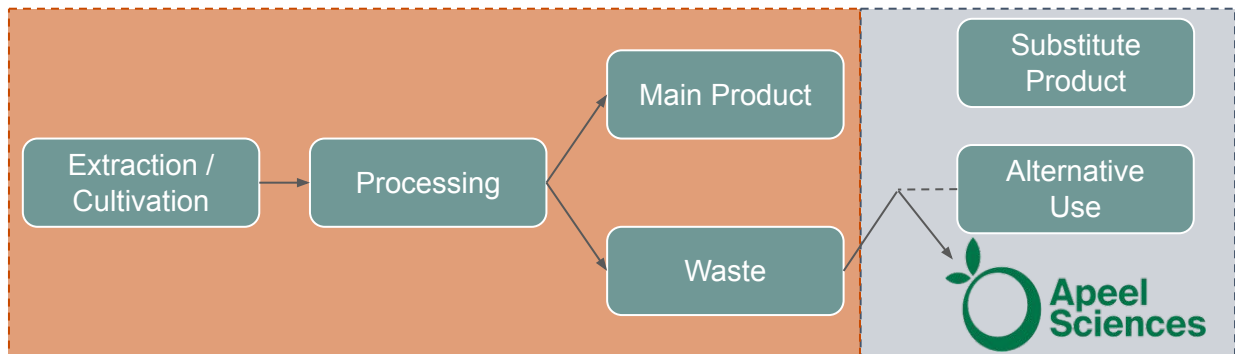
The rationale: Replicate a common method businesses use to assess supply chains.

Substitution

How it works: Assign the environmental impacts from additional production of a substitute product (fertilizer, animal feed, etc.) caused by Apeel's sourcing decision

The rationale: Captures the consequence of the sourcing practice.

Scenario Analysis

The scenario analysis investigates how key parameters of a scenario affect the calculated environmental impacts. These include:

Price: Affects economic allocation results

Amount of additional production: Affects substitution

Additional data: Do the results change when we include additional process like dehydration?

Generalizing methodology

We distilled our findings from this analysis into a tool any business can use when considering the environmental impacts of sourcing a waste.

All wastes studied had alternative uses.
All four materials we investigated had alternative uses, suggesting they are not always wastes. We chose the scenarios shown below for our quantitative analysis.

Grape Pomace
Primary product: Wine
Potential Use(s): Animal Feed, Fertilizer

Cocoa Husks
Primary product: Chocolate
Potential Use(s): Biofuel, Fertilizer

Coffee Cherries
Primary product: Coffee
Potential Use(s): Animal Feed, Fertilizer

Olive Pomace
Primary product: Olive Oil
Potential Use(s): Secondary Vegetable Oil, Fertilizer

Different methodologies resulted in different choices.
We calculated environmental impacts in four categories, including global warming potential (above). Results varied widely based on the LCA method used: importantly, the material with the lowest calculated impacts differed if one method was used over another.

Baseline Results
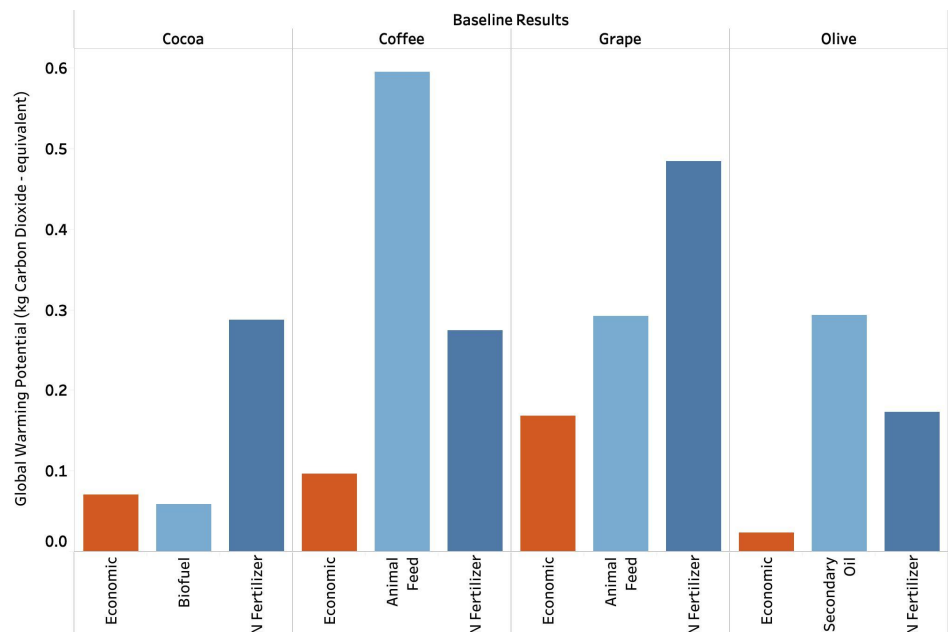
Conclusion

Commonplace or more accessible methods may not successfully capture all the impacts of a business switching to a circular supply chain. We hope this project helps enable businesses to take a more holistic approach to their sourcing decisions. To this end we have included access to our tool to facilitate this process.

To access our tool and evaluate environmental impacts of a waste, please scan this code!
bit.ly/WasteWatchersTool

Acknowledgements

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