

Latent  
ecologies:

Guiding climate  
decisions with  
design

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Product Designer, Terrascope

Design Matters 2024, 24 October 2024

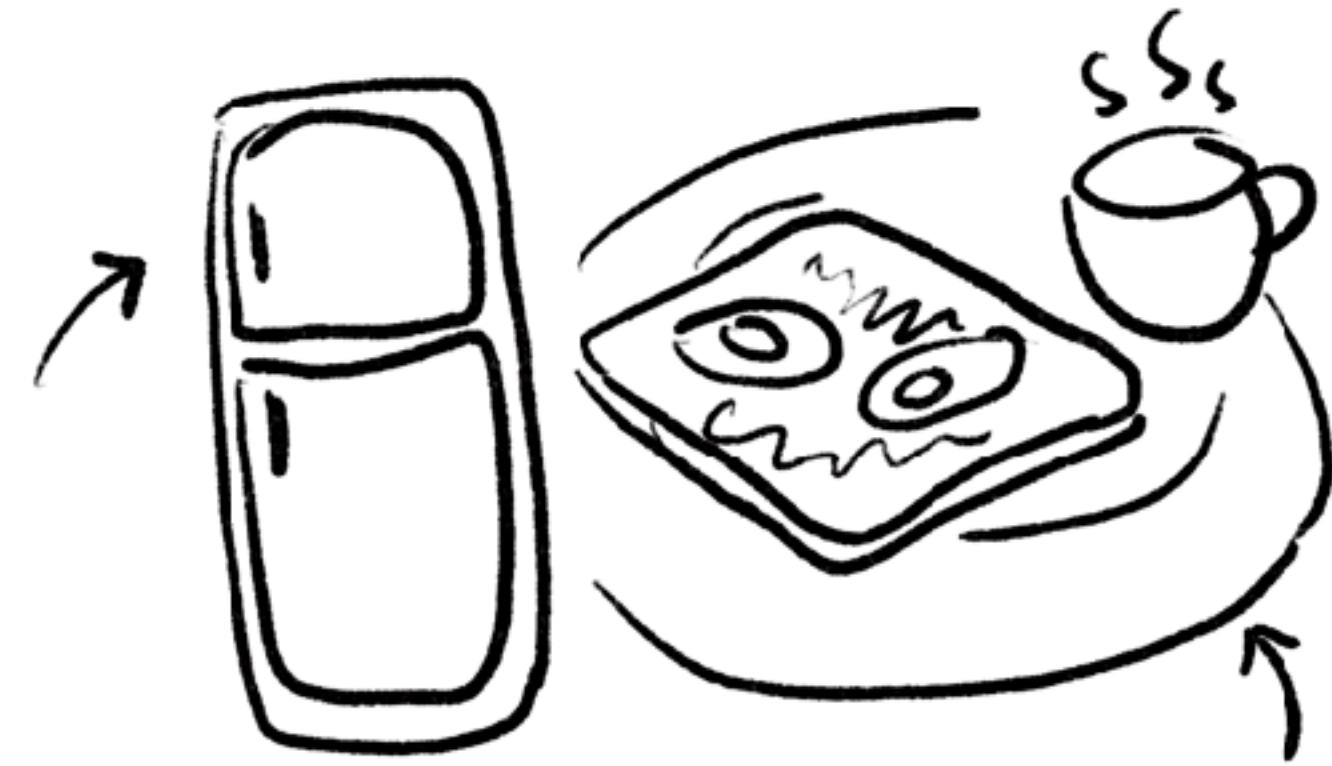
# climate decision:

Any choice, action, or policy that directly or indirectly affects the climate... particularly in terms of greenhouse gas emissions and overall environmental impact.





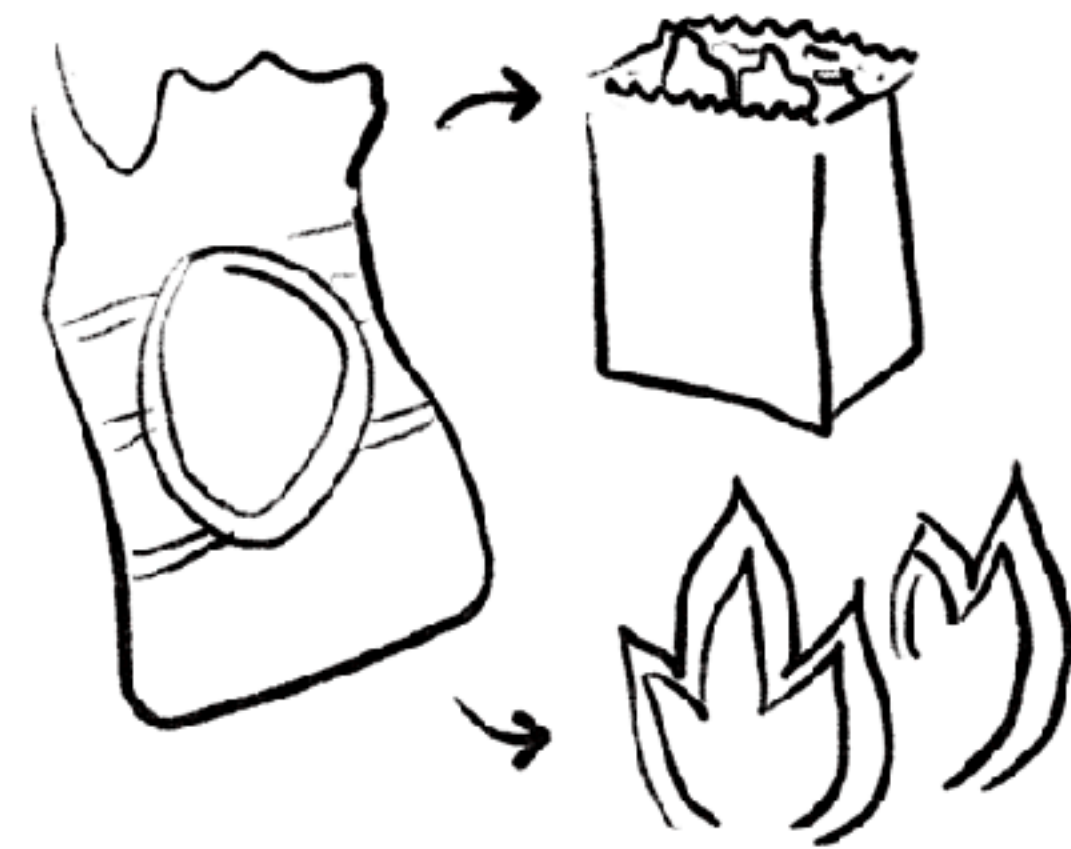
Transportation  
Walking or taxi?



Storage  
Freezing or eating it fresh?

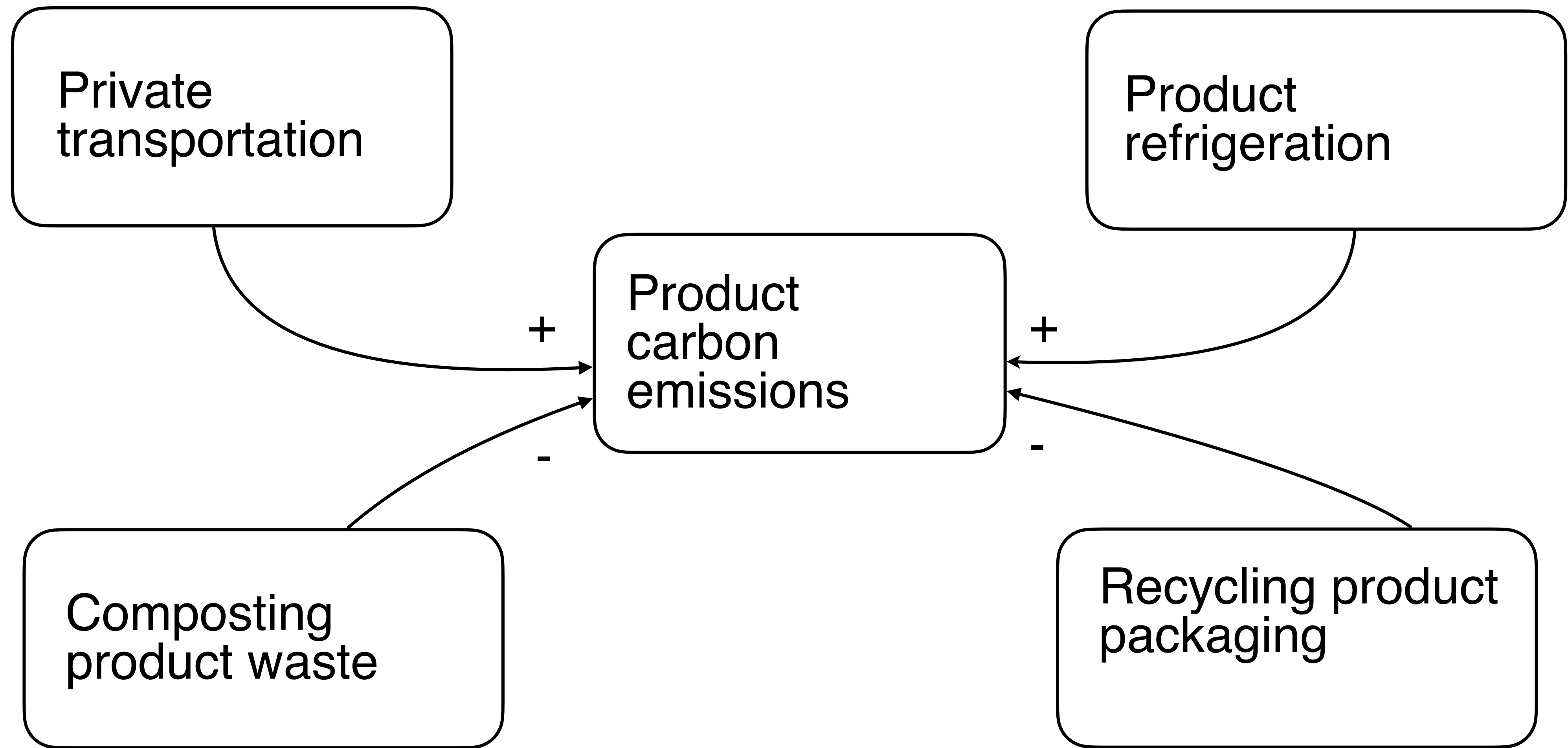


Food disposal  
Landfill or compost?



Packaging disposal  
Recycling or incineration?

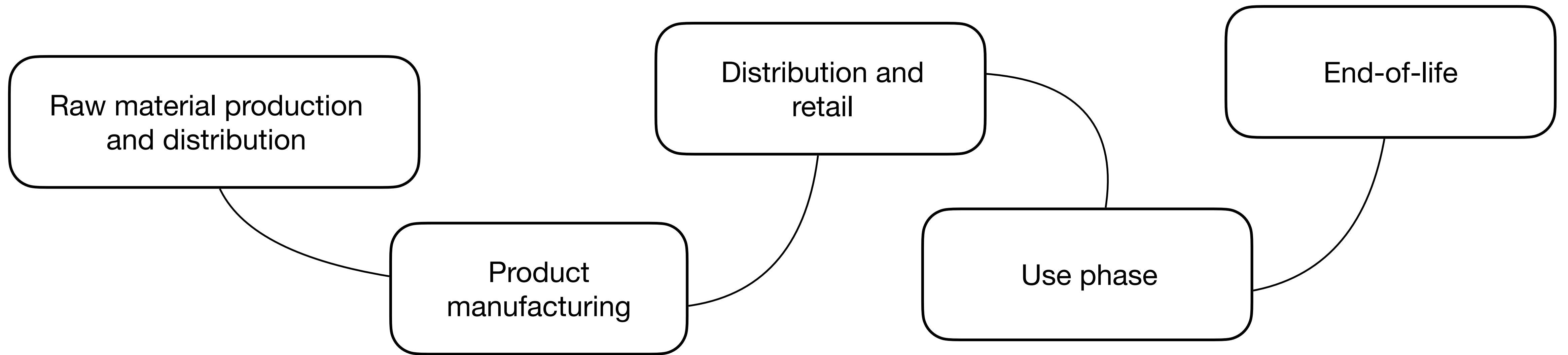




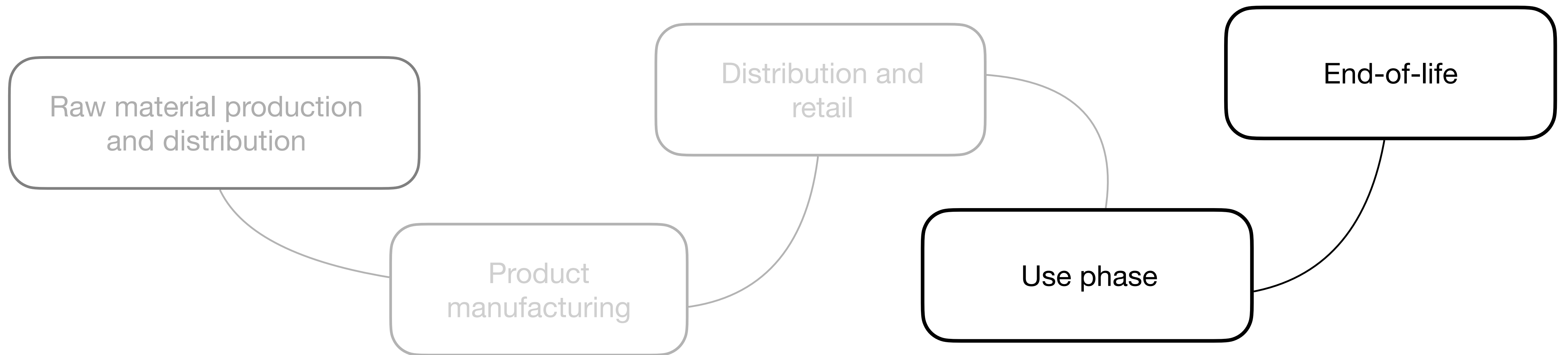
# The product lifecycle



# The product lifecycle



# Consumer choices matter



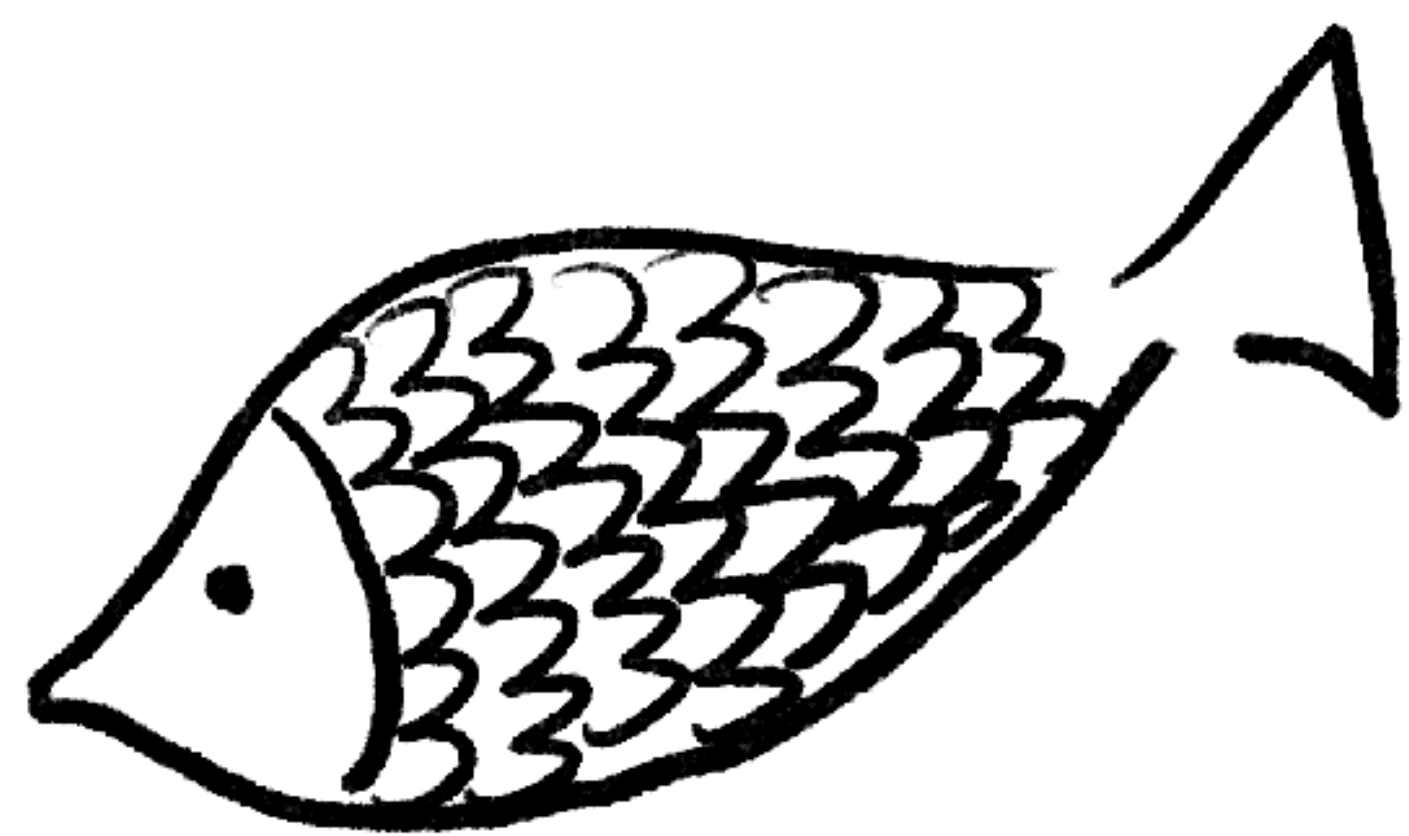


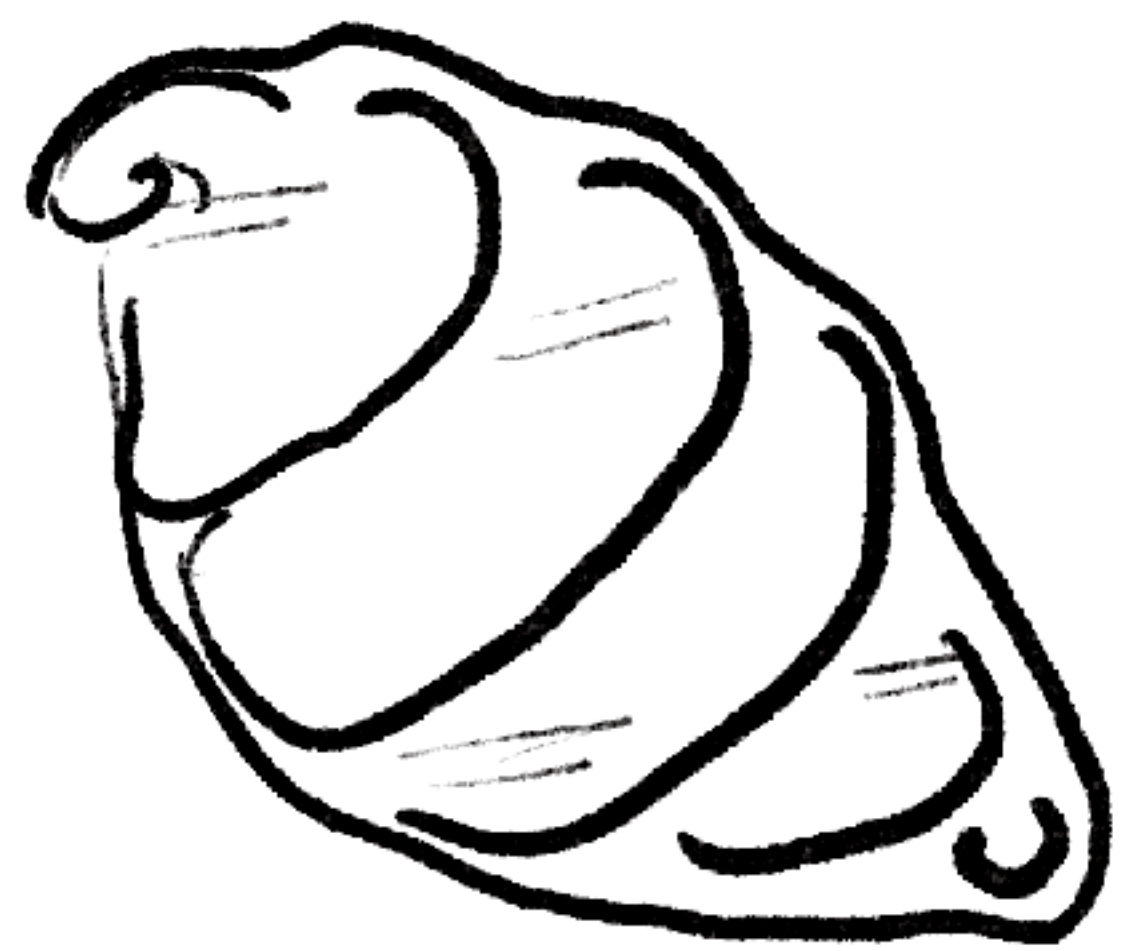
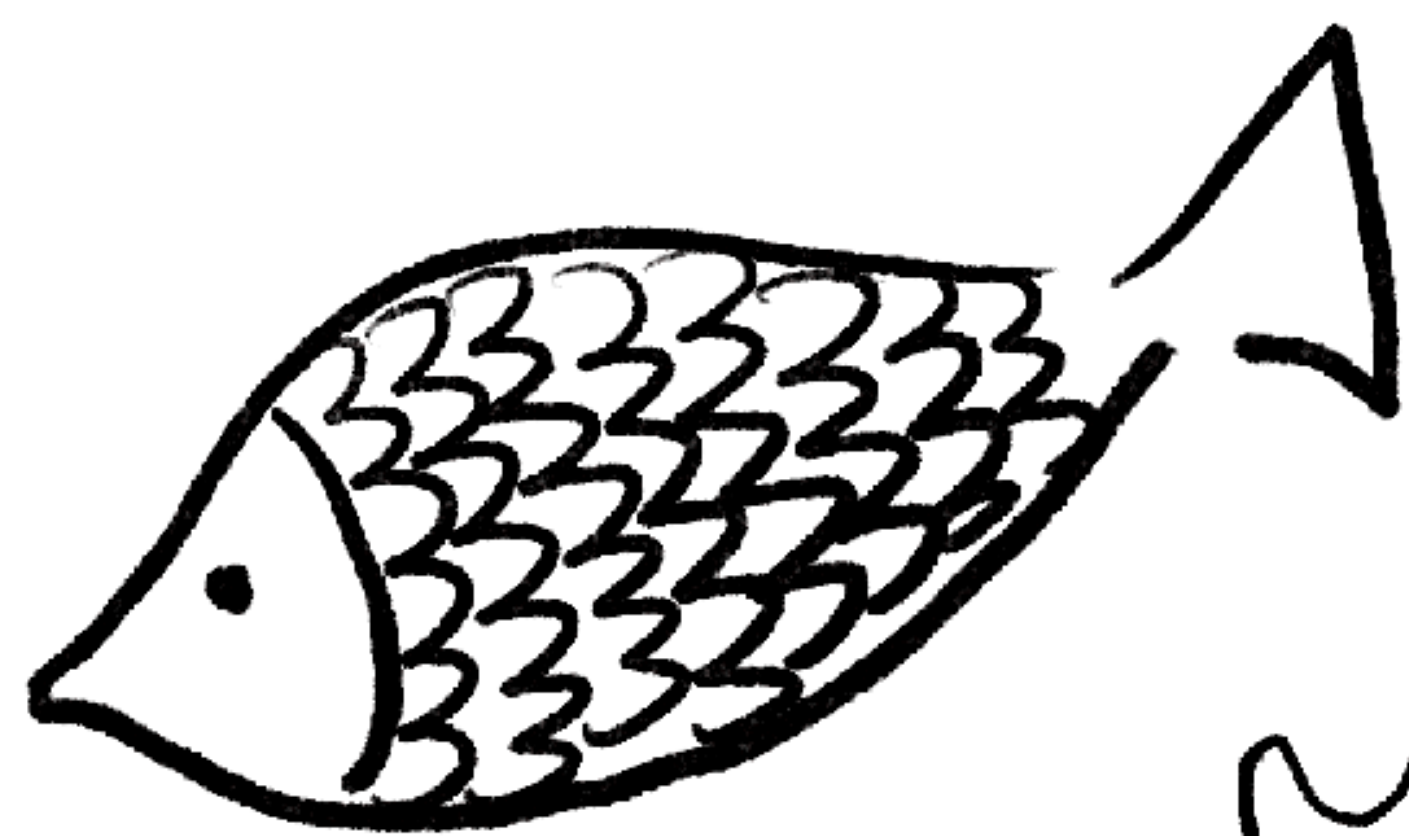
# Chapter (net) Zero

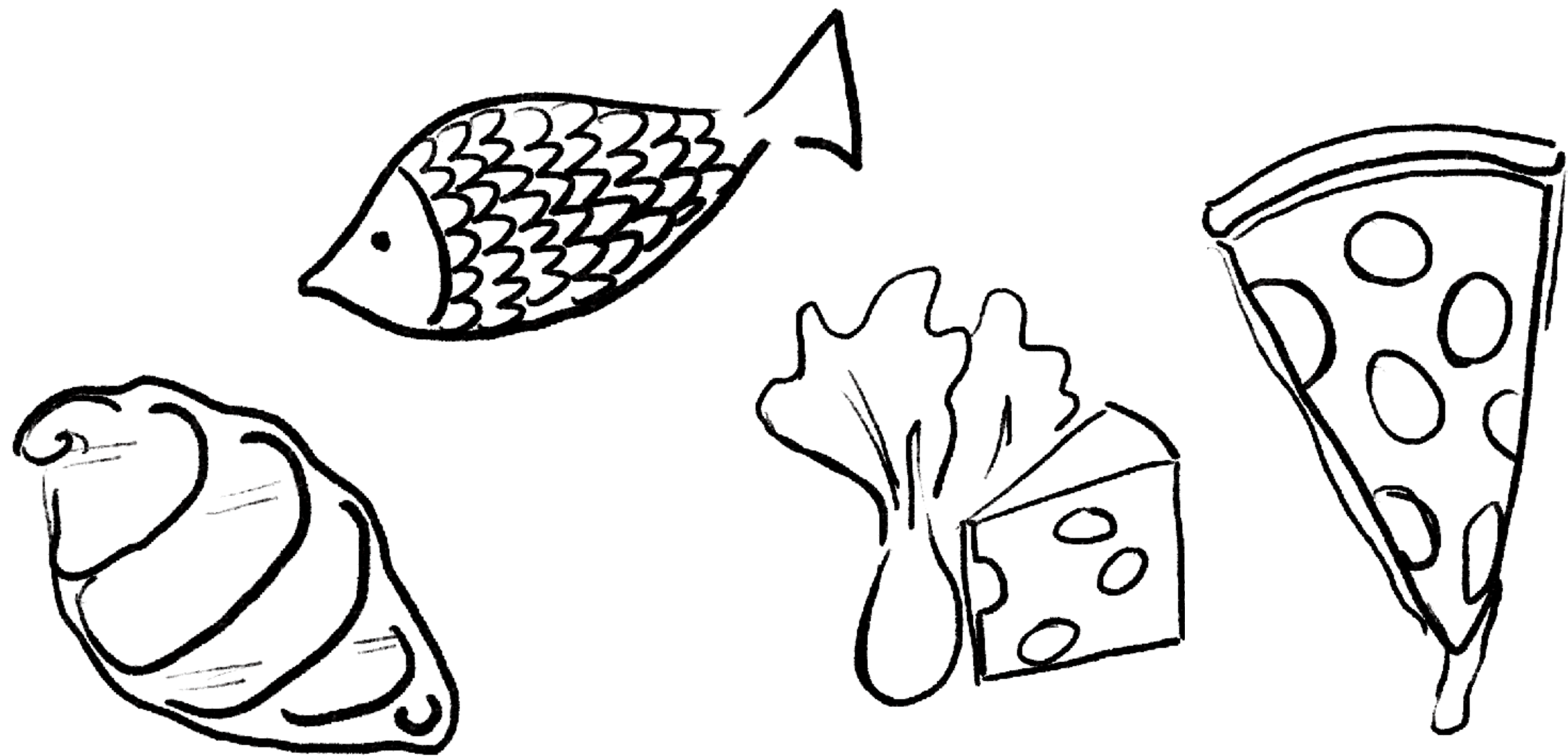
Hidden  
ecologies  
weave beneath  
everything we  
eat









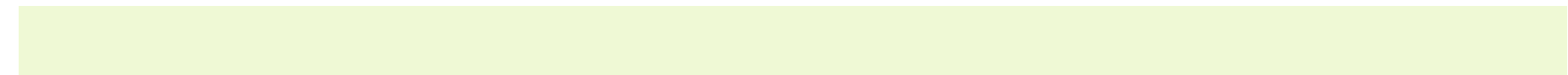


# 26% of global emissions

Food and agriculture (26%)



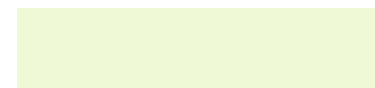
Manufacturing and consumption (21%)



Transportation (16-18%)



Aviation and shipping (4-5%)



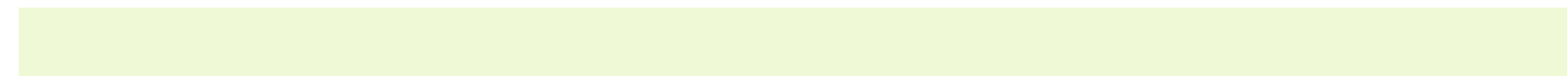


# Why is it challenging to get the information we need?

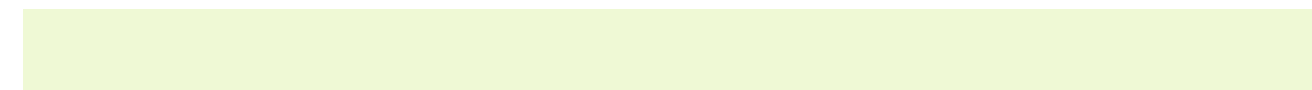
Food and agriculture (26%)



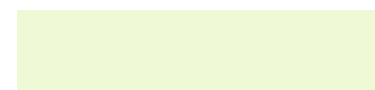
Manufacturing and consumption (21%)



Transportation (16-18%)



Aviation and shipping (4-5%)



Systems  
thinking:

Viewing parts  
as inter-  
connected  
within a whole

California College of the Arts  
BFA Interaction Design





# Microsoft Anti-harassment on Microsoft Teams (2020)

**Thank you for making Teams safer!**  
Check your email inbox for an acknowledgement of this report and updates from your administrator. ⓘ

Please contact your local emergency services if someone is in immediate danger.

**Let your administrator know about an inappropriate message.**  
Your administrator may remove it from this chat and send an email to the sender. Your report is completely anonymous to others in the chat. ⓘ

- Self-harm
- Sexual harassment
- Violent
- Racist
- Anti-disability
- Crude language
- Homophobic
- Xenophobic
- Disrespectful or mean
- Other
- Calling me names
- Flag as inappropriate



**Let your administrator know about an inappropriate message.**  
Your administrator may remove it from this chat and send an email to the message sender. Your report is completely anonymous to others in the chat. ⓘ

- Select all that apply (Optional)
- Self-harm
  - Sexual harassment
  - Violent
  - Racist
  - Anti-disability
  - Crude language
  - Homophobic
  - Disrespectful or mean
  - Xenophobic
  - Other
  - Flag as inappropriate

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# Scale AI Machine learning for autonomous vehicles (2022)

Berkeley Deep Drive 12685 items

truck

Regular Querying Natural Language BETA

truck

Try also

a photo of a truck

> Learn more about Natural Language queries

IoU	Confidence
0.721	0.955
0.729	0.476
0.750	0.797
0.750	0.336
0.750	0.006
0.750	0.336
0.750	0.063
0.751	0.956
0.751	0.029
0.751	0.958
0.751	0.252
0.850	0.754
0.850	0.397
0.850	0.754
0.750	0.053
0.751	0.966
0.751	0.029
0.751	0.958

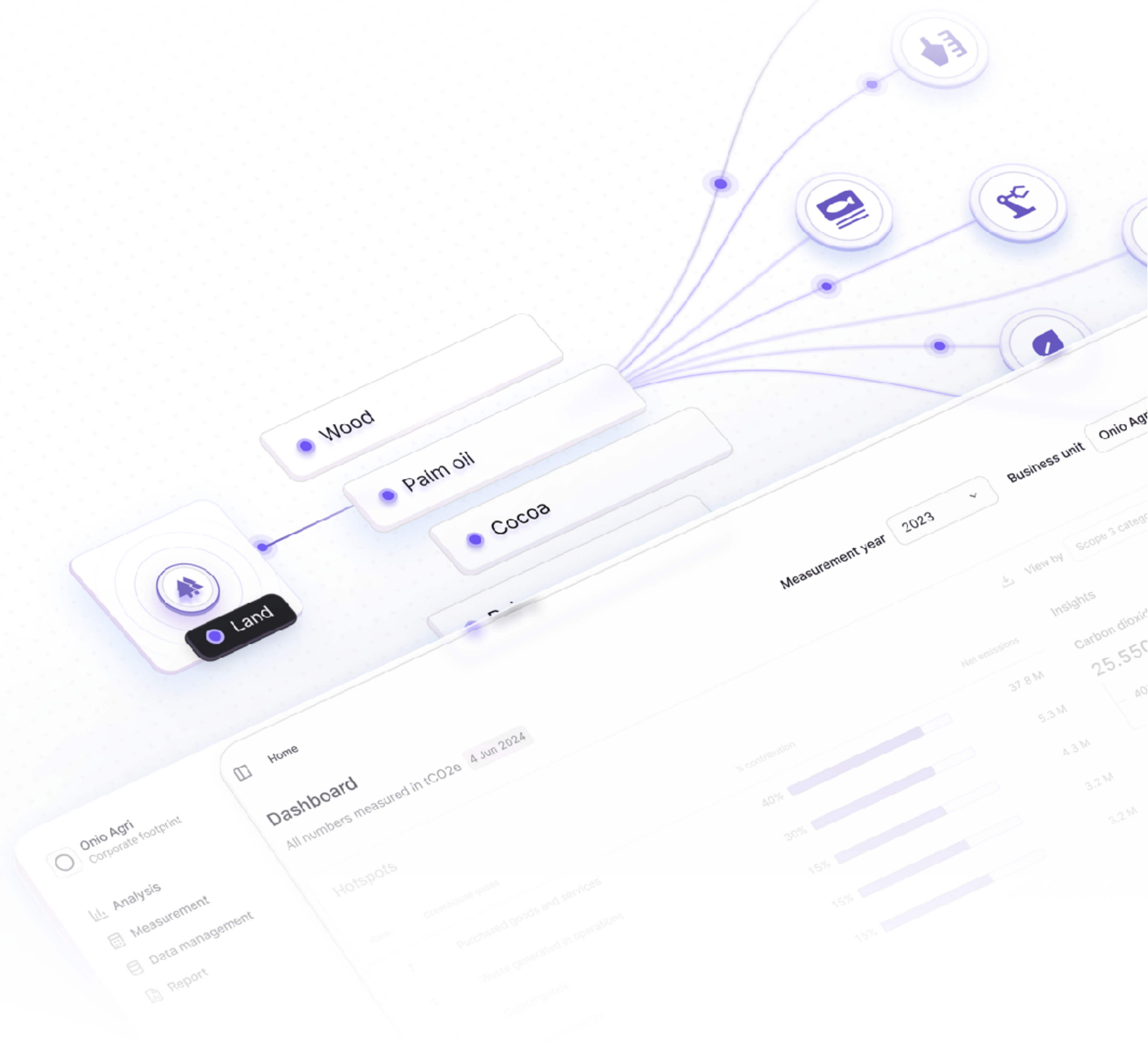


# Chapter One

Designer as  
system  
excavator



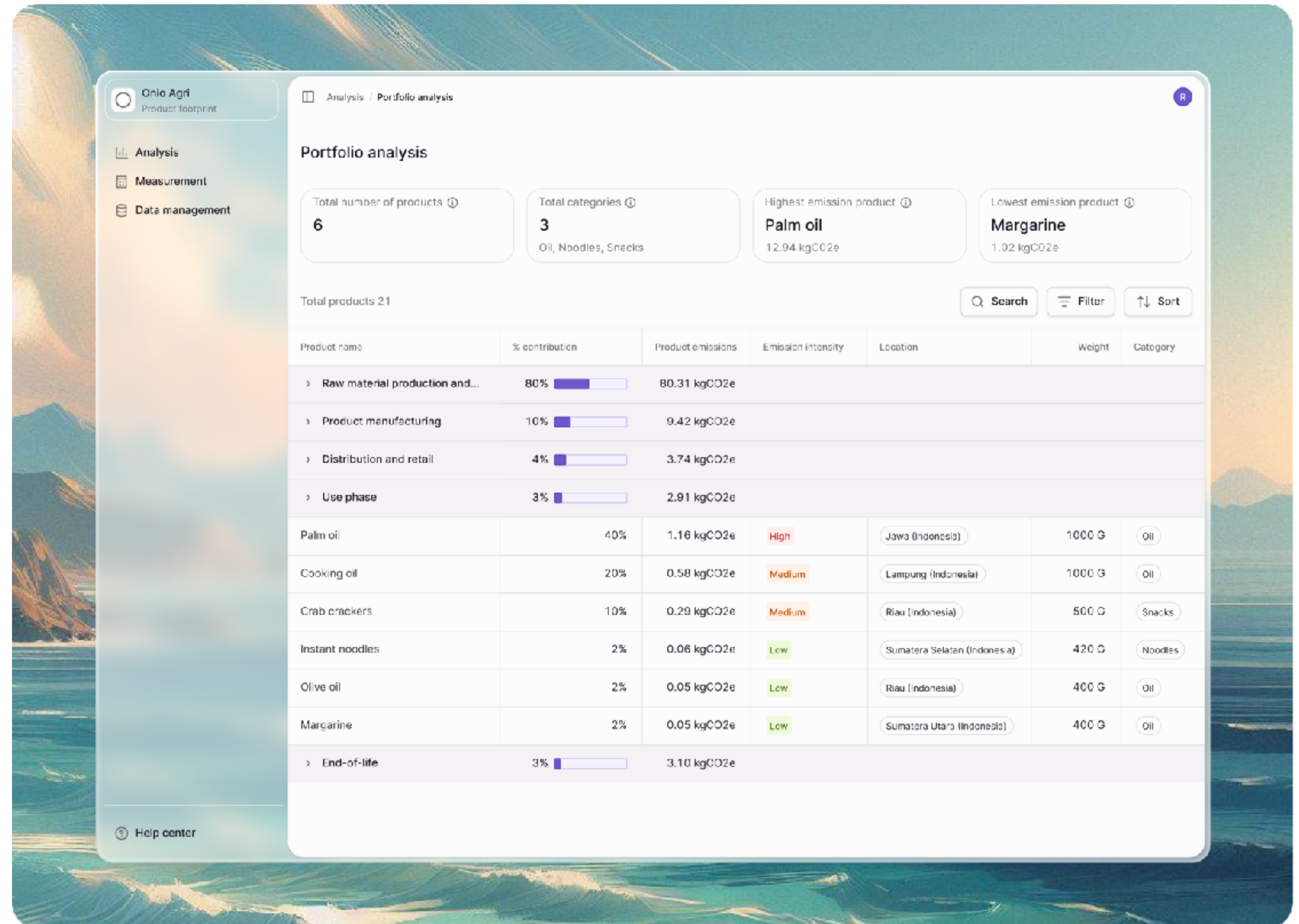
Terrascope  
End-to-end decarbonisation tool  
for the land-based economy



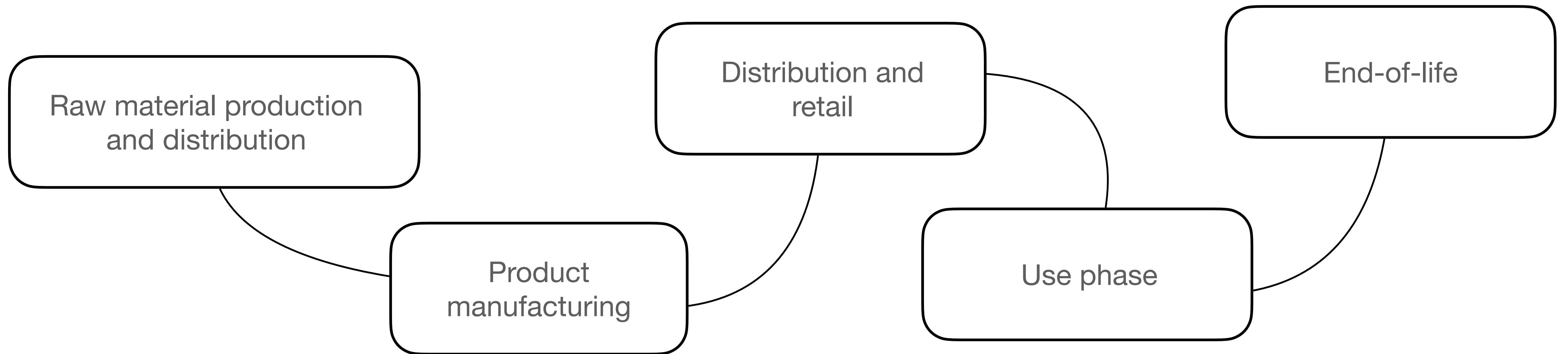


# Product Carbon Footprinting

Fast, accurate emissions across your product lifecycle



# Cradle-to-grave emissions






Where are  
emission  
hotspots in rye  
bread?



Image: Michael Balle-Pedersen



# Step 0 : Creating a product SKU

 **Add new product**  
You may edit details later on in individual product pages.

<b>Product Name</b> e.g. "Green Lentils"	<b>SKU ID (optional)</b> e.g. PCF-001
<b>Select Category</b> e.g. "Agriculture" ▼	<b>Manufacturing Location</b> Enter [City, Country]
<b>Weight</b> e.g. 150	<b>Unit</b> Unit ▼
<b>Measurement boundary</b> Select ▼	
Methodology developed in accordance to the Pathfinder Framework (PACT) by WBCSD	
<b>What are the objectives of your PCF measurement?</b> Select ▼	
<b>Is this product manufactured or purchased by your organisation?</b> Select ▼	

# Step 1 : Raw material production and distribution

Measurement / Products / Rye Bread

**Rye Bread**  
500g

Overview **Add Data**

Save and Exit

- Raw Material Production and Distribution
- Product Manufacturing
- Distribution and Retail
- Use Phase
- End-of-life

## Step 2 : Product manufacturing

Measurement / Products / Rye Bread

RA

### Ingredients

If you need to update or modify raw materials, please go back to the previous life cycle stage.

+ Add data row

Input Name	Weight	Unit	Processing Method	Energy Source	Energy Consumption	Waste Disposal
Rye grain	104.241	g	Select	Select	Select	Select
Water	371.914	g	Select	Select	Select	Select
Salt	0.001	g	Select	Select	Select	Select
Sourdough Starter	23.844	g	Select	Select	Select	Select

Calculate Emissions

▼ Distribution and Retail

▼ Use Phase

▼ End-of-life

✓ Emission calculated for Raw Material Production and Distribution



# Step 3 : Distribution and Retail

## ^ Distribution and Retail

### Distribution

Emission relating to the distribution and transportation of your finished product.

Product Destination	Transportation Mode	Distance
City, Country	Select Transport ^	

### Storage

Emission relating to the storage of your finished product at its destination.

Calculation Meth... v



Required

Select calculation method from the dropdown

Calculate Emissions

## v Use Phase

# Step 4 : Use phase

## ^ Use Phase

### Shopping Transportation

Emissions relating to the shopping transportation of your product by the consumer.

Shopping Transportation Method	Distance	Average Weight
Select		500000 G

Private Vehicle

Public Transport - Bus

Public Transport - Rail

Bicycle

Walk

Product Use Method	Energy Source	Energy Consumption
Select	Select	7

### Product Use

Emissions relating to the use of your product by the consumer.

# Step 5 : End-of-life

Use Phase

End-of-life

Product Waste

Emissions relating to the disposal of your product.

+ Add data row

Waste Type	Waste Disposal	% Wastage
Organic: food and drink waste	Select	

Packaging Waste

If you need to update or modify packaging options, please go back to 'Raw Material Production and Distribution'.

+ Add data row

Packaging Data	Waste Disposal	% Wastage
Plastics: average plastics	Select	

✓ Emission calculated for Use Phase

Calculate Emissions

Measurement / Products / Rye Bread

## Rye Bread

500g

Overview

Add Data



Emissions per unit

1.5330 kgCO<sub>2</sub>e

Life cycle stages

Raw Material Production and Distribution

kgCO<sub>2</sub>e

0.2720

Product Manufacturing

1.2090

Distribution and Retail

0.0510

Use Phase

0.0010

End-of-life

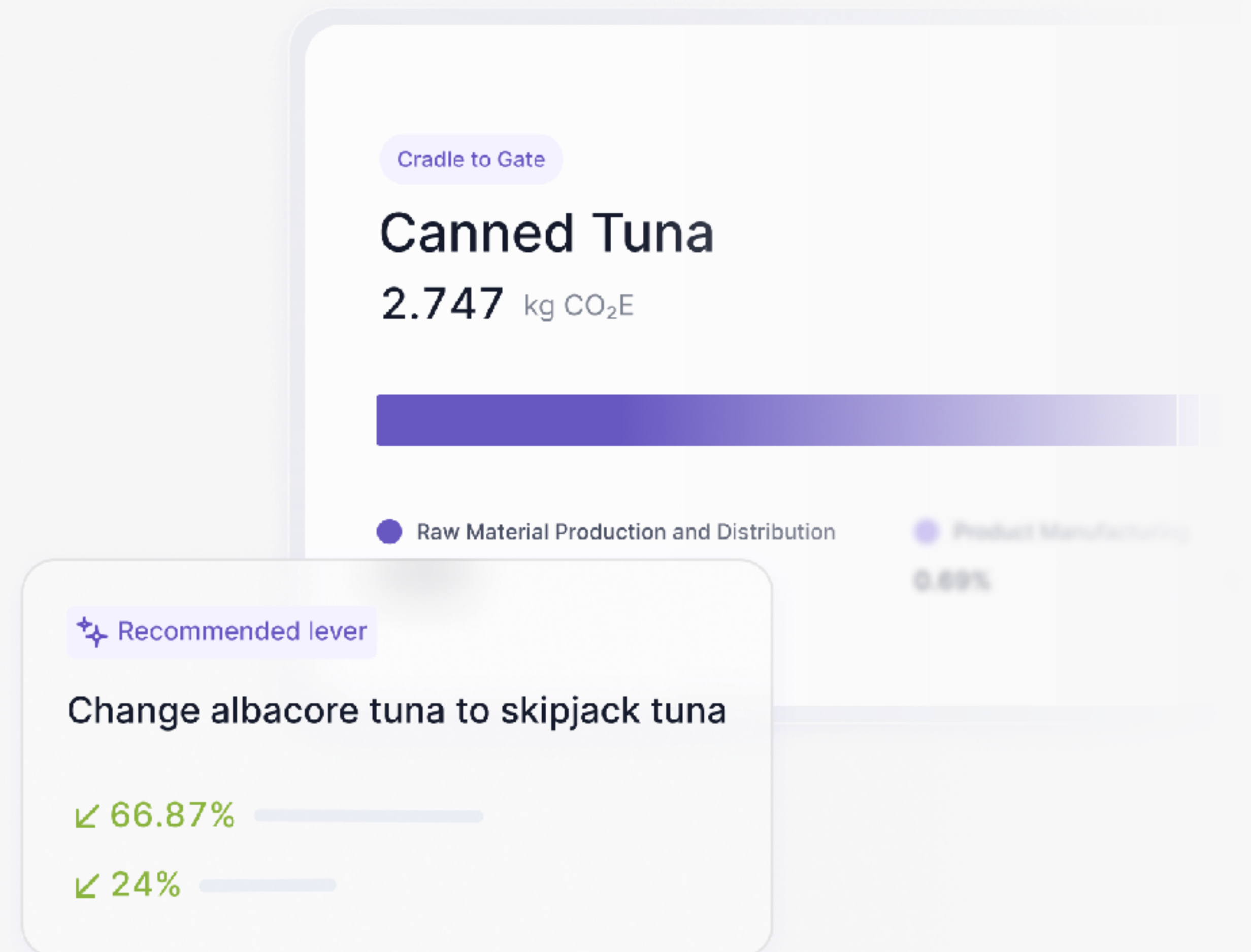
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# Chapter Two

Designer as  
system  
architect

# What design decisions did I make here?



Design decision 1  
Exposing the mental model of the  
product lifecycle to the user

Raw Material Production and Distribution

Ingredients + Add data row

Input Name	EF Match	% Wastage	% Loss	Origin	Transport	Distance	Weight	Unit
Enter		0	0	City, Country	Select			g

Packaging + Add data row

Input Name	EF Match	Type		Origin	Transport	Distance	Weight	Unit
Select		Select		City, Country	Select			g

Calculate Emissions

Product Manufacturing

Distribution and Retail

Use Phase

End-of-life



Design decision 2  
Simplifying the data input process  
for non-experts, by referencing  
verified datasets

Input Name	EF Match	Origin
Mussels	Shellfish EF ▾	Italy ⇅
Olive Oil	Olive Oil EF ▾	Italy ⇅
Dill	Herb EF ▾	Italy ⇅

AI Matching...

### Change emission factor

Herbs EF

Match relevance





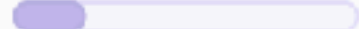



0.98

France

Composite SKU

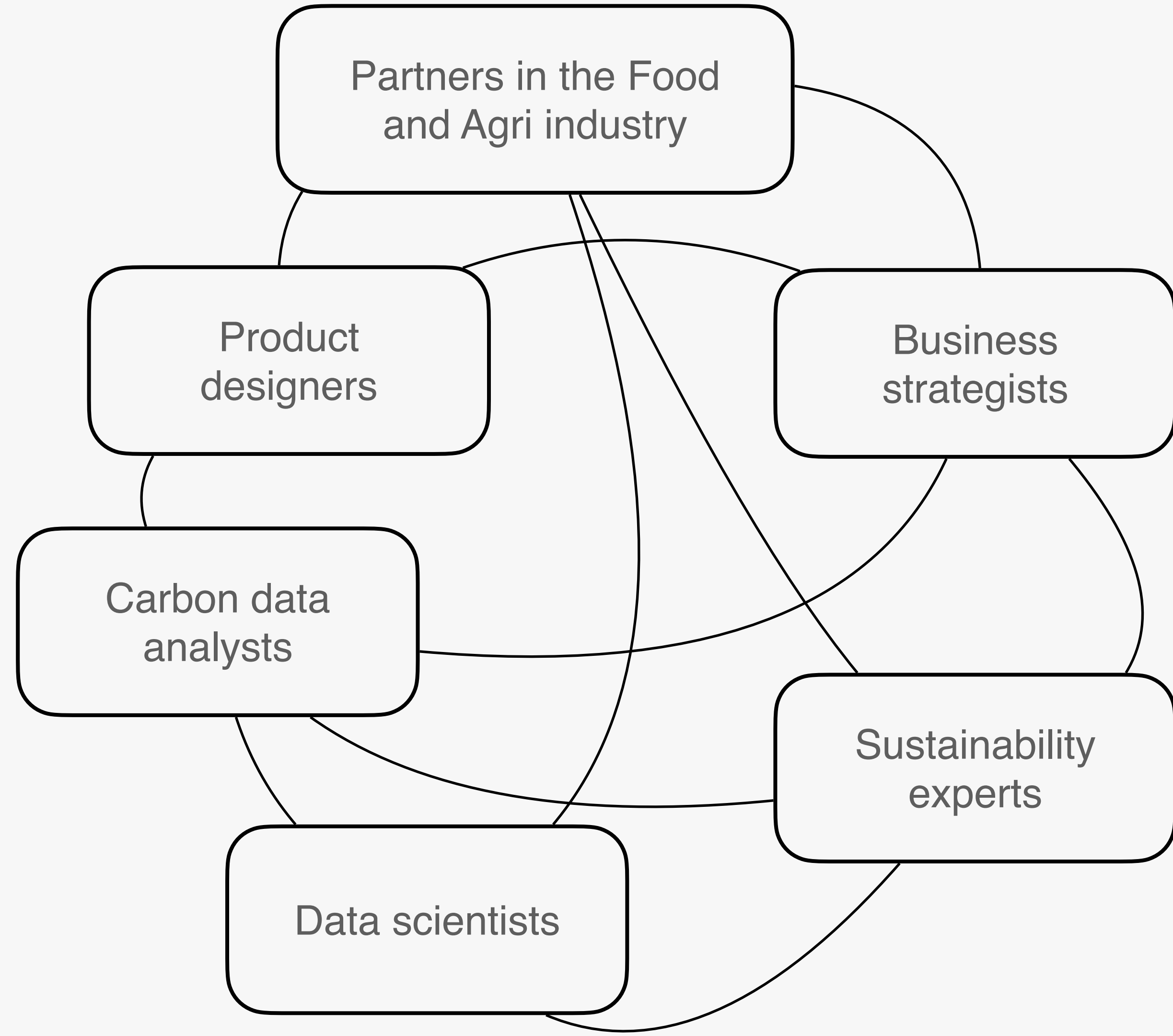
Herbs UK EF

Celery EF

<input type="checkbox"/> Product name	Boundary	% Completeness	Emissions (kgCO2e)	Manufacturing...	Category	SKU ID
<input type="checkbox"/> Canned Tuna	Cradle to gate	0% 	--	Selangor, Malay	Seafood	PCF-100105
<input type="checkbox"/> Canned Salmon	Cradle to grave	25% 	0.4600	Lampung, Indor	Seafood	PCF-100104
<input type="checkbox"/> Canned Corn Kernels	Cradle to gate	100% 	2.018	Riau, Indonesia	Vegetables	PCF-100100
<input type="checkbox"/> Canned Beef Stew	Cradle to grave	74% 	2.018	Sumatera Selata	Meat	PCF-100102
<input type="checkbox"/> Canned Diced Tomatoes	Cradle to grave	22% 	1.102	Riau, Indonesia	Vegetables	PCF-100101
<input type="checkbox"/> Canned Corn Kernels	Cradle to grave	22% 	2.018	Sumatera Utara	Vegetables	PCF-100100
<input type="checkbox"/> Canned Green Beans	Cradle to gate	100% 	1.312	Indonesia	Vegetables	PCF-100099
<input type="checkbox"/> Canned Sweet Peas	Cradle to gate	100% 	0.01844	Riau, Indonesia	Vegetables	PCF-100098

Design decision 3:  
 Providing a high-level overview  
 of emissions across one's  
 product portfolio

Design decision 4  
Making product decisions that  
reflect the diversity of our users



## Design decision 4 Making product decisions that reflect the diversity of our users

common to chemist explore adding a g duplicating products.

Product manufacturing

The challenge

There is no option to group the ingredients into components for eg. each product might consist of five components as in case of MFT and we are required to allocate processing method of component even for the not possible to do this today.

The platform requires input or process method for each individual ingredient, separately eg. chicken, salt, cooking oil. This approach is problematic because:

1. It is cumbersome and error-prone.
2. The cooking method is specified for each ingredient, even though the combination of cooking steps is not always the same (e.g. salt, and then again for 100g of chicken).

Can we align to existing recipes, but avoid the need for the user to specify the cooking method?

Not clear what is included in this stage (e.g. salt for waste data in the table but the whole case of waste is calculated from previous stage).

I wish for:

- Unlock the restriction that one line of ingredients must follow the processing method. Allow flexibility to:
  1. Combine multiple ingredients into one intermediary product (e.g. one line for salt, fresh chicken, one another line for chicken salt and oil).
  2. Input multiple processing steps, e.g. its fried chicken can be combined with cooked rice, fried rice, and then refrigerated.
- Enable input of self-serve (in the unit of oil, or tsp or energy consumption).
- Ability to group raw materials and allocate one large processing method.
- Unlock the link between raw materials and processing, so the changes are made to raw materials, processing energy does not need to be layered in again.

Does this approach seem feasible from the DB perspective?

add multiple processing stages

Notice allowing 'tagging' of components in the first LCA stage and then allowing each component to be processed with one cooking method?

Quantitative:
 

- change in name is made to the other stages reflecting change
- dividing a raw material into two with exact the same amount
- allowing inventories and production manufacturing
- raw material stage -- "ingredient"

### Feature prioritisation \*\*\*

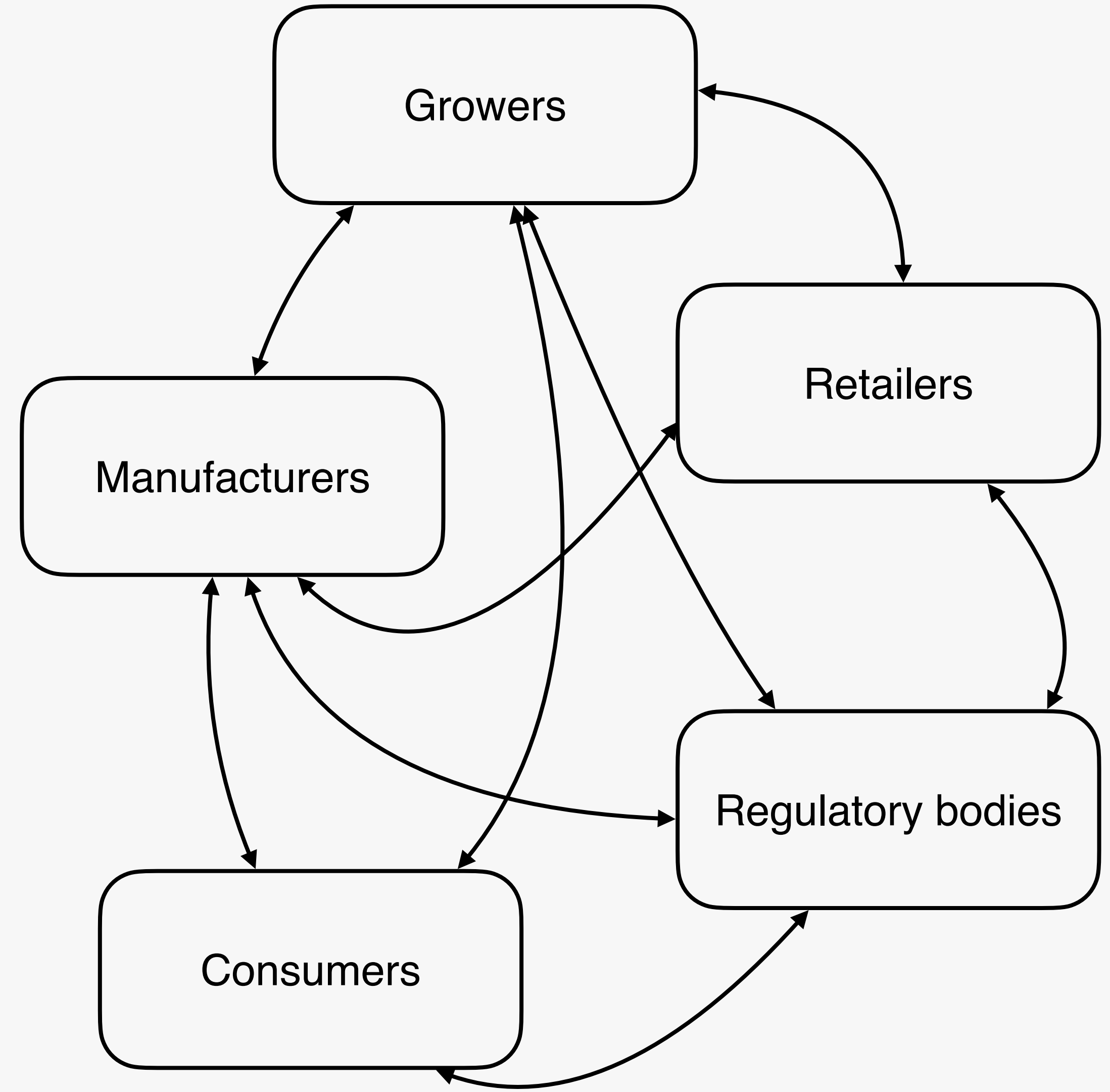
urgency	lca	problem solved	status	Aa feature may look like...	theme
Very high	LCA1	Foods often shrink in weight, and grow in weight sometimes in their manufacturing process. Hence, the starting weight of raw materials do not always equate to the final weight. At the moment, we don't have a way to accommodate this realistic process.	implemented	In LCA 1, allowing users to select a dropdown item (finished weight / starting weight).	Self-serve ISO
Very high	Product ... All LCAs	Duplication so the user can simulate different manufacturing processes	implementing...	Provide manufacturing location as an editable option for our user.	Self-serve Customer-Driven
Very high	LCA1 LCA2	Currently, users are only able to work with the EFs that we have provided them. However, prospective customers like Sigma foods, as well as current customers like Lawson need a way to add their own EFDBs.  - This mandates having orgID-specific EF configs	eng review	Allow EFDB configs to <input type="checkbox"/> OPEN created on the backend that intakes the customer's EFs.	Self-serve Customer-Driven



# Chapter Three

Designer as  
system agitator

# The network effect for information sharing



# Exposing levers to lower emissions

For Danish rye bread

Swap natural gas for renewable  
energy in the baking process

79% lower emissions

Swap transportation from diesel van  
to electric vehicle

5% lower emissions

Swap packaging from virgin plastic  
to compostable paper packaging

3% lower emissions

# Original measurement

Product Manufacturing

**Ingredients**  
If you need to update or modify raw materials, please go back to the previous life cycle stage.

[+ Add data row](#)

Input Name	Weight	Unit	Processing Method	Energy Source	Energy Consumption	Waste Disposal
Rye grain	104.241	g	cooking - baking	Fuels, Gaseous fuels, ↑	4.594 mj	Composting
Water	371.914	g	cooking - baking	Fuels, Gaseous fuels, ↑	4.708 mj	Not Applicable
Salt	0.001	g	cooking - baking	Fuels, Gaseous fuels, ↑	4.55 mj	Not Applicable
Sourdough Starter	23.844	g	cooking - baking	Fuels, Gaseous fuels, ↑	4.56 mj	Not Applicable

FOR THIS STAGE  
1.209 kg CO2e [Calculate Emissions](#)



Swapping natural gas for renewable energy

Product Manufacturing

**Ingredients**

If you need to update or modify raw materials, please go back to the previous life cycle stage.

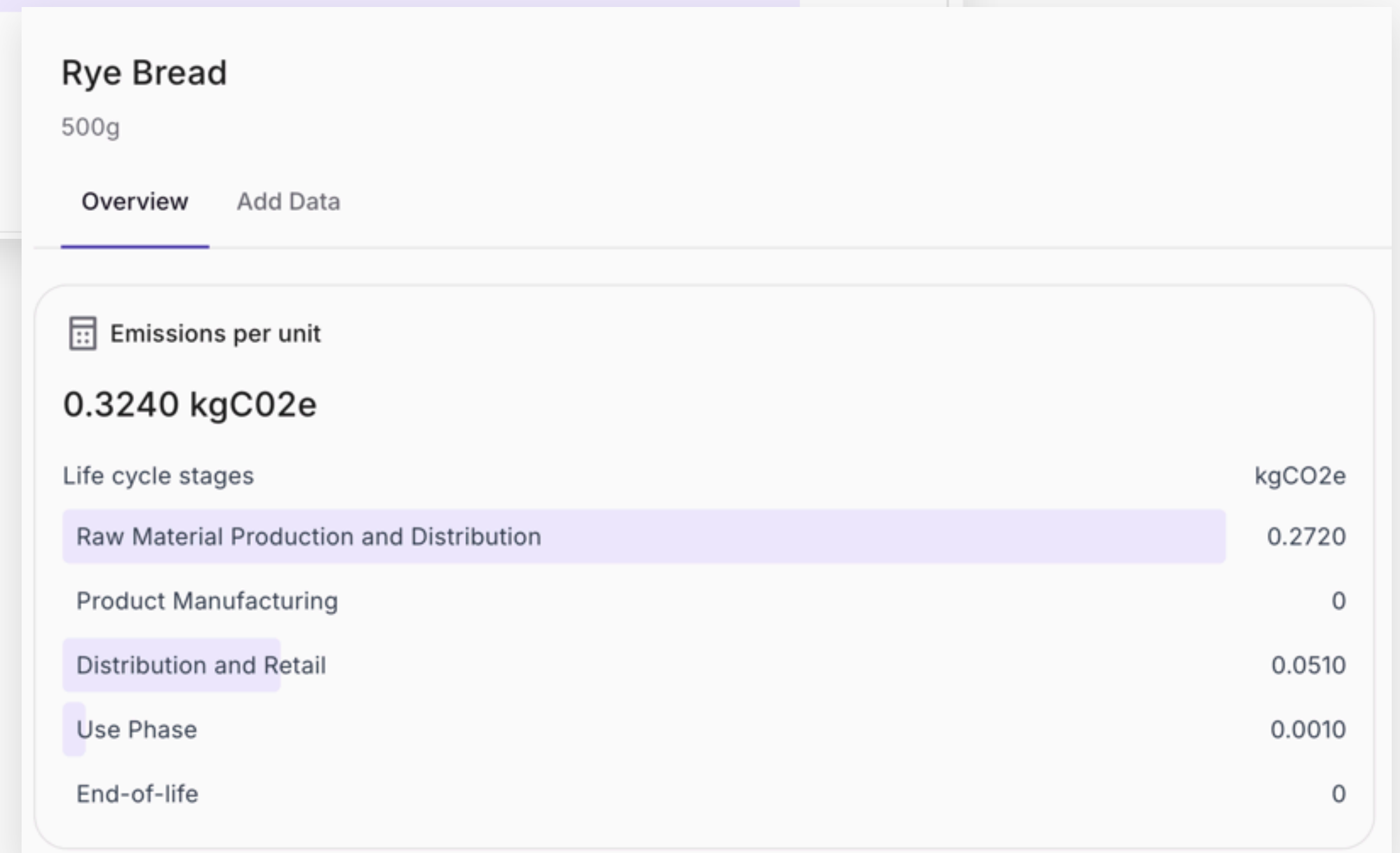
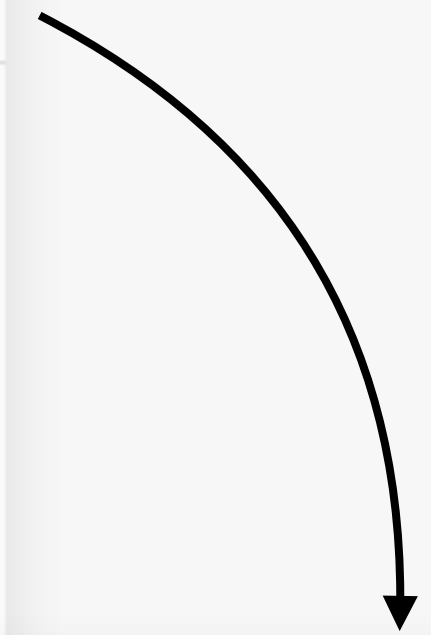
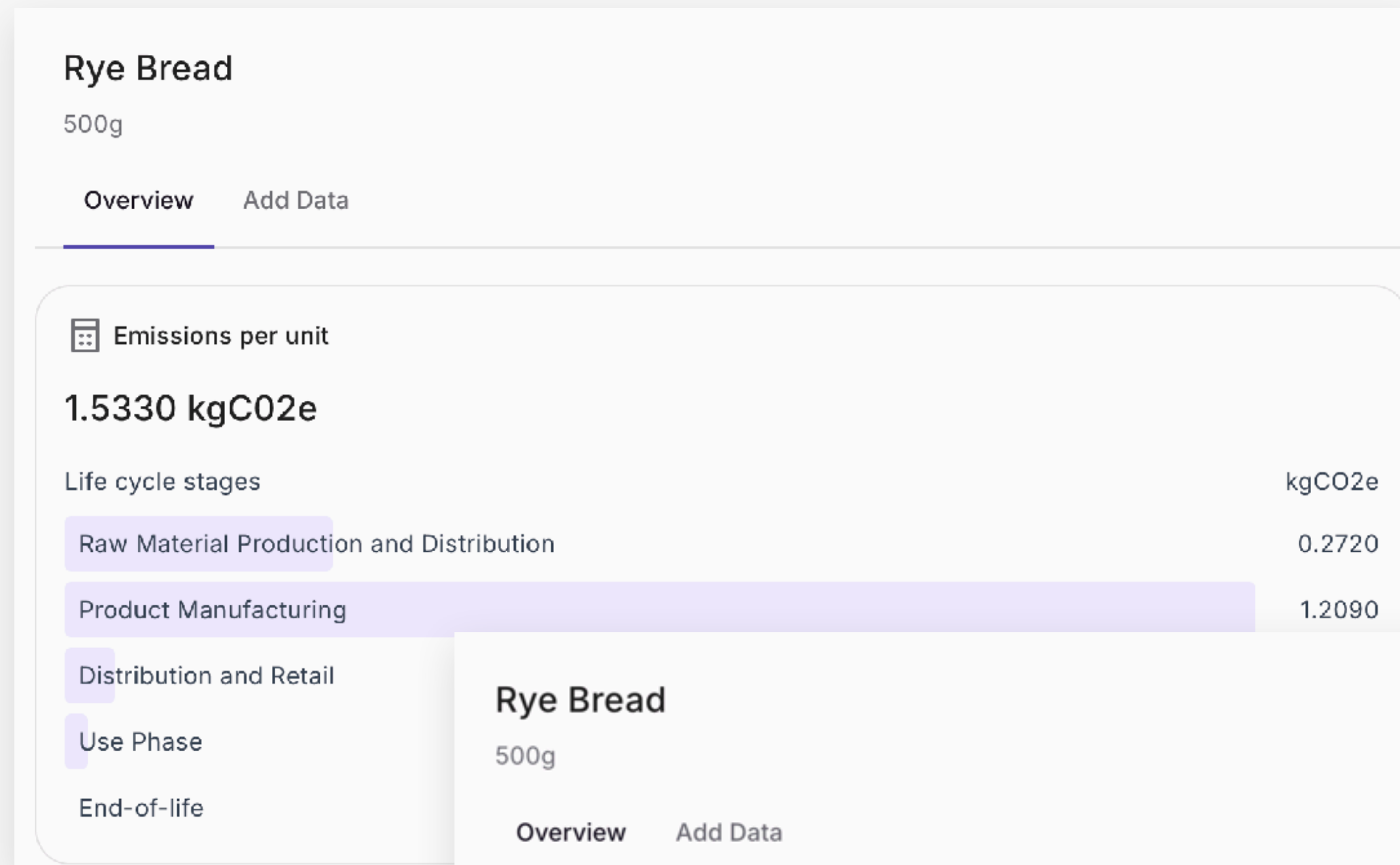
[+ Add data row](#)

Input Name	Weight	Unit	Processing Method	Energy Source	Energy Consumption	Waste Disposal
Rye grain	104.241	g	cooking - baking	Renewable Energy	4.594 mj	Composting
Water	371.914	g	cooking - baking	Renewable Energy	4.708 mj	Not Applicable
Salt	0.001	g	cooking - baking	Renewable Energy	4.55 mj	Not Applicable
Sourdough Starter	23.844	g	cooking - baking	Renewable Energy	4.56 mj	Not Applicable

FOR THIS STAGE  
0 kg CO2e

[Calculate Emissions](#)

With the right information, small actions have outsized impact





What impact will informed consumers have on the industry?





# Chapter Four

Designer as  
agent of  
systemic  
change

Expose



Re-architect



Agitate  
hidden systems

What latent  
ecologies lie  
under your feet  
today?

# Thank you!

Design Team  
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Lia Nicholson  
Sianghou Tang  
Jochen Schloesser

Limited trial available at  
[pcf-demo.terrascope.com](http://pcf-demo.terrascope.com)



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