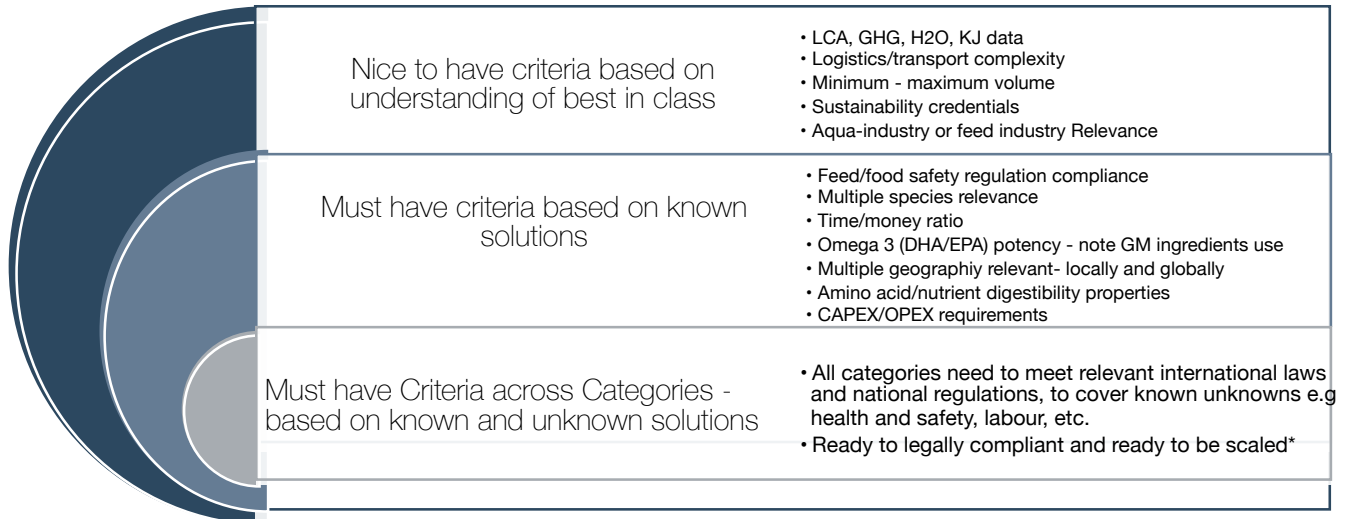


# Categories to be de-risked in Stage 3

Purpose of the document is to guide the category de-risking approach

## CRITERIA DEVELOPMENT



## I. FEED INGREDIENT CATEGORIES:

Across all categories for feed ingredients, they must be applicable to Salmon and Shrimp feed; while also avoiding negative impacts associated with less sustainable ingredients (e.g. GHG emissions and BD loss), and promote positive environmental outcomes.

a) Nutritional solutions creating net positive environmental effects using waste streams, including but not limited to: food co-products, CO<sub>2</sub> and energy.

*Priority solutions are:*

1. Protein (processed or concentrated) or starch from locally available food co-product waste-stream (e.g. cassava, and land animals- non ruminants)
2. Protein from insects fed on Food material and/or food industry co-product-list (EU 2017/1017)
3. Protein from fermentation processes
  - a) Microbial - Sustainable CO<sub>2</sub> source, bio-gas
  - b) Food material waste-stream or food industry co-product (sugars)
  - c) Waste product such as: cellulose
4. Protein from using energy (e.g. from the production in Skretting facilities)

*\*Proteins created through currently unknown innovations (cannot be de-risked in detail, but as part of the overall criteria considerations)*

b) Nutritional solutions creating the health effects equal to or greater than fatty acids (e.g. DHA-EPA)

*Priority solutions are:*

5. Oil sources (plant based) of Omega-3 from:
  - a) Microbes (incl. Micro-Algae)
  - b) Sea-weed
  - c) GM microbes or seaweeds or other Plants

*\*Oils created through currently unknown innovations (cannot be de-risked in detail, but as part of the overall*

- c) Nutritional solutions using inputs that create environmentally restorative effects (i.e. kelp forests harvested as a source that also support ecosystem rehabilitation )

*Priority solutions are:*

6. Protein from seaweeds (process or concentrated)
7. Protein from insects fed on seaweeds

## II. FEED PRODUCTION CATEGORIES:

Applicable to Salmon and Shrimp feed: Feed use efficiency through innovations that directly avoid negative environmental impacts i.e. GHG emissions and BD loss associated with feed production processes in factories.

- d) Technology solutions creating net positive effects using renewable energy, packaging waste, energy waste, sustainable transport.

*Priority solutions are:*

- Use of solar and wave power to produce/test feed and ingredients
- Use of packaging waste to reduce recycling of plastic and/ or its plastic going to waste
- Creation of co-products from energy production in Skretting facilities
- Systems that can map local food waste streams and the nearest processing to provide local inputs into local feed plants – ensuring local regions have logistical access to local food waste ingredients

\* *Unknown technology innovations (cannot be de-risked in detail, but as part of the overall categories)*

## III. FEED PERFORMANCE CATEGORIES:

Across all categories for feed performance, they must be applicable to Salmon and Shrimp feed; while also improving feed use efficiency through solutions that indirectly avoid **negative impacts associated with** salmon and shrimp production systems (e.g. GHG emissions and BD loss), and promote positive environmental outcomes.

- e) Technology solutions increasing the health, survival and growth performance of the fish/shrimp

*Priority solutions are:*

- Integrated technologies incorporating digital monitoring to increase the health, survival and growth performance of the fish/shrimp (i.e. including digital health control, A.I. biomass control)

- f) Integrated information systems solutions increasing feed waste efficiencies

*Priority solutions are:*

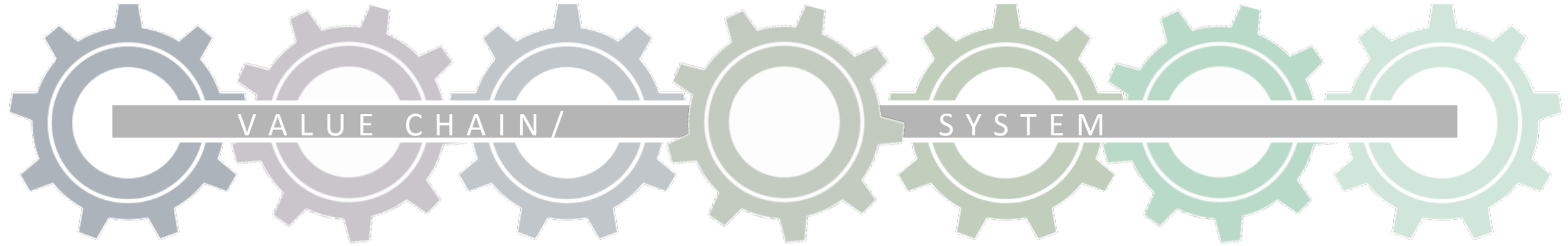
- Systems (digital or otherwise) that use co-products including sludge water from pens or ponds

- g) Innovations moving the whole farm production foot print off land

- \* Unknown innovations (cannot be de-risked in detail, but as part of the overall categories)

*Scoping means that the researchers identify broad issues and risks associated with the category focus (I, II, and III) that may need to be considered at a later stage once more detailed innovations are selected. Category de-risking assessments of the priority solutions may be possible for category I.*

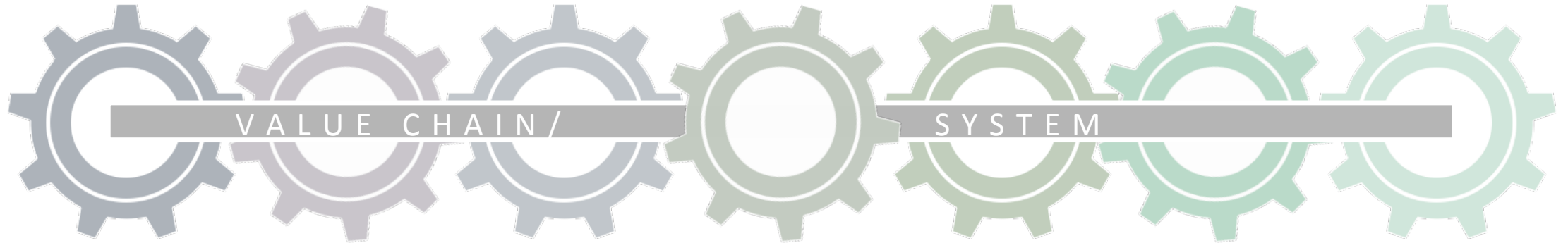
# TERMINOLOGY



# DEFINITIONS



*HOTSPOT: What are areas of strongly negative environmental and/or social impacts for each identified stakeholder?*



*COLD SPOT: What are areas/ locations in the system for potential intervention for each stakeholder?*



*CATEGORY: a lack or a needs statement that describes the intervention into the system opening the door for innovation.*



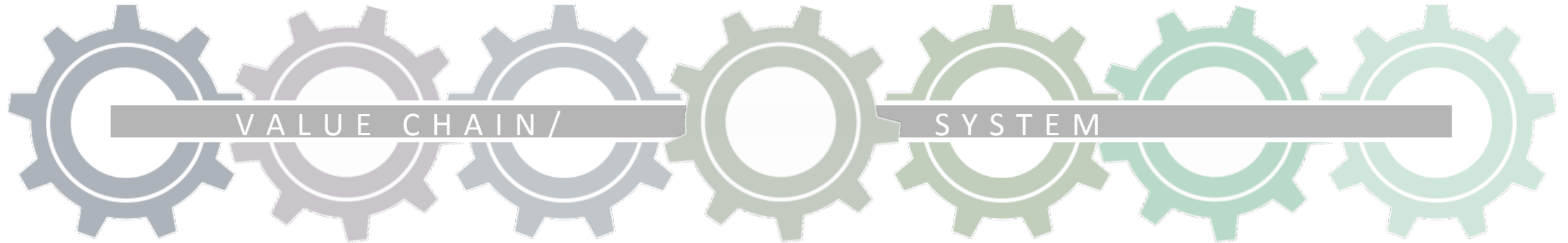
*SOLUTION: Means of addressing the lack/ needs described in the category using innovative thinking.*

# WORKED EXAMPLE

## Non-feed

**HOTSPOT**  
There is no cake – people are unhappy about this

*HOTSPOT: What are areas of strongly negative environmental and/or social impacts for each identified stakeholder?*



**COLD SPOT**  
3pm sugar crash

*COLD SPOT: What are areas/ locations in the system for potential intervention for each stakeholder?*

**CATEGORY**  
Low impact way of delivering energy at the right time.

*CATEGORY: a lack or a needs outcome statement that describes the intervention into the system opening the door for innovation.*

**'Traditional' solution:**  
Cookies/ muffins

**Energy management innovation:**  
Eating more protein/ veg

**'Wild card' innovation:**  
Meditation app used at 3pm

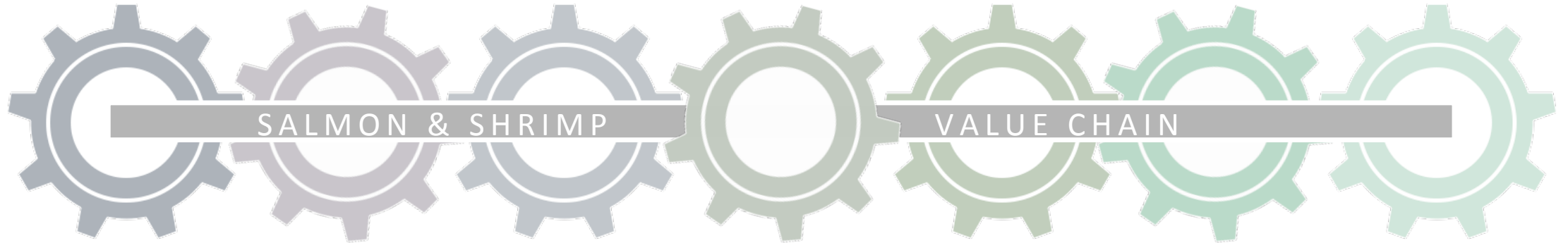
*SOLUTION: Actions or Means of addressing the lack/ needs described in the category using innovative thinking.*

# WORKED EXAMPLE

## FEED X



*HOTSPOT: What are areas of strongly negative environmental and/or social impacts for each identified stakeholder?*



*COLD SPOT: What are areas/locations in the system for potential intervention for each stakeholder?*



*CATEGORY: a lack or a needs outcome statement that describes the intervention into the system opening the door for innovation.*

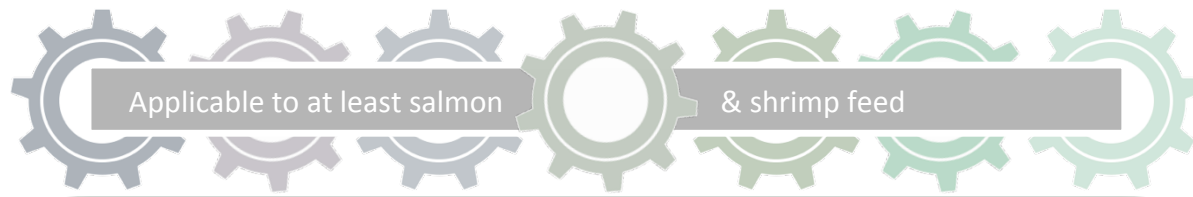
**'Traditional' solution:**  
New Proteins and oils

**Energy management innovation:**  
Animal produces own O-3

**'Wild card' innovation:**  
Innovative protein conversion

*SOLUTION: Actions or Means of addressing the lack/ needs described in the category using innovative thinking.*

WORKED  
EXAMPLE  
FEED X



**CATEGORY - OUTCOME**  
Nutritional solutions creating net positive effects using sustainable waste-streams including but not limited to food materials, CO<sub>2</sub> and energy.

**CATEGORY - OUTCOME**  
Nutritional solutions creating health effects equal to or greater than fatty acids (e.g. DHA-EPA).

**CATEGORY - OUTCOME**  
Nutritional solutions using inputs that create environmentally restorative effects (e.g. kelp that are used as part of ecosystem rehabilitation).

●●●  
**Outputs**

- 'Traditional' Protein replacement solution:**
  1. Protein (processed or concentrated) or starch from locally available food material
  2. Protein from Insects fed on Food material
  3. Protein from fermentation processes using waste-streams
- Waste Energy management innovation:**
  4. Unknown Protein from using energy waste
- 'Wild card' innovation:**

Proteins created through currently unknown innovations

●●●  
**Outputs**

- 'Traditional' oil replacement solution:**
  5. Oil sources (plant based) of Omega-3
    - Microbes
    - Seaweed
    - GM
- Animal Health management innovation:**
- 'Wild card' innovation:**
  - Fatty acids created through currently unknown innovations

●●●  
**Outputs**

- 'Traditional' input solution:**
  6. Protein from seaweeds (process or concentrated)
  7. Protein from insects fed on Seaweeds
- Environmentally restorative innovation:**
- 'Wild card' innovation:**

Unknown environmentally restorative effect created through currently unknown feed innovation



# Category De-risking

## SYSTEM-CATEGORIES

I) FEED INGREDIENT

II) FEED PRODUCTION

III) FEED PERFORMANCE

### CATEGORIES THAT ARE SOLUTION AGNOSTIC; TO BE EXAMINED AND REDUCED IN NUMBER

a) Nutritional solutions creating net positive environmental effects using waste-streams, including but not limited to: food material, CO<sub>2</sub> and energy.

b) Nutritional solutions creating health effects equal to or greater than fatty acids (e.g. DHA-EPA)

c) Nutritional solutions using inputs that create environmentally restorative effects (e.g. kelp forests harvested as a source that also support ecosystem rehabilitation)

d) Technology solutions creating net positive effects using renewable energy, packaging waste, energy waste, sustainable transport.

e) Technology solutions increasing the health, survival and growth performance of the fish/shrimp

f) Integrated information systems solutions increasing feed waste efficiencies

g) Innovations moving the whole farm production foot print off land

### SOLUTION LEVEL: PRIORITY EXAMPLES SELECTED INCLUDE ...

Protein (processed or concentrated) or starch from locally available food waste stream (e.g. cassava and land animals)

Protein from Insects fed on Food material and/or food industry co-products

Protein from fermentation processes using waste-streams



Unknown Protein from using energy waste or land animal protein

Oil sources (plant based) of Omega-3

Protein from seaweeds (process or concentrated)

Protein from insects fed on seaweeds

Use of solar and wave power to produce/test feed and ingredients

... ?

Integrated technologies incorporating digital monitoring to increase the health, survival and growth performance of the fish/shrimp (i.e. including digital health control, A.I. biomass control)

Systems (digital or otherwise) that use co-products including sludge water from pens or ponds

? Unknown innovations



Project X document

2018

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