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Integrated Methodology for Product Design Including Sustainability Criteria and Palm Oil Value Chain Requirements

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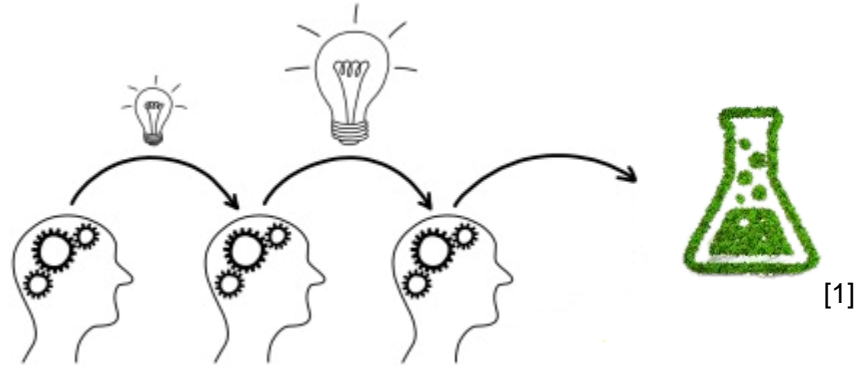
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Product Design

Product design a process that involves **creating new products** to be sold by a business to its customers. It involves understanding the **needs of the customers**, creating a concept that can fulfill these needs, and transforming this concept into a physical product

Chemical Product Design: It's the application of chemical engineering principles to the design of new products, often involving the conversion of raw materials into valuable forms



Product Design Challenges

Gani, R (2004) Chemical product design: challenges and opportunities

Martin, M (2019) Challenges and future directions for process and product synthesis and design

Taifouris, M (2020) Challenges in the design of formulated products: multiscale process and product design



Sustainability



**Innovative
Design Methods**



**Supply Chain
Complexity**



**Life Cycle
Assessment (LCA)**



**Complexity
of Products**



**Integration of
Design and Control**

Value chain

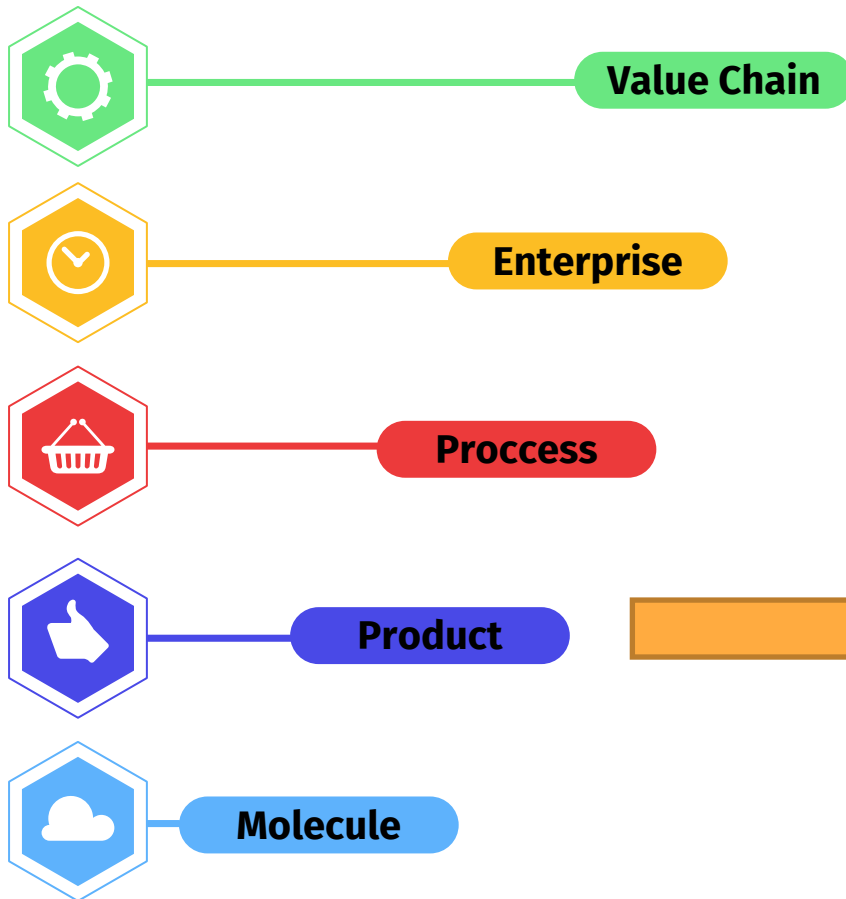
The value chain encompasses all the activities that are performed to create and deliver a product, from raw material to final product delivery.

Case of study: Palm oil in Colombia



How to connect these two scales?

Multiscale Approach



Proporsal: Methodology for CPD considering the value chain requirements



Literature
Review



Interviews



Limitations
identification



Scenario
Approach



Evaluation of
limitations



Ingredient
Definition

Objective:
Limitation
identification
Value/supply chain
mapping

Objective:
Include the value
chain limitations in
the product design

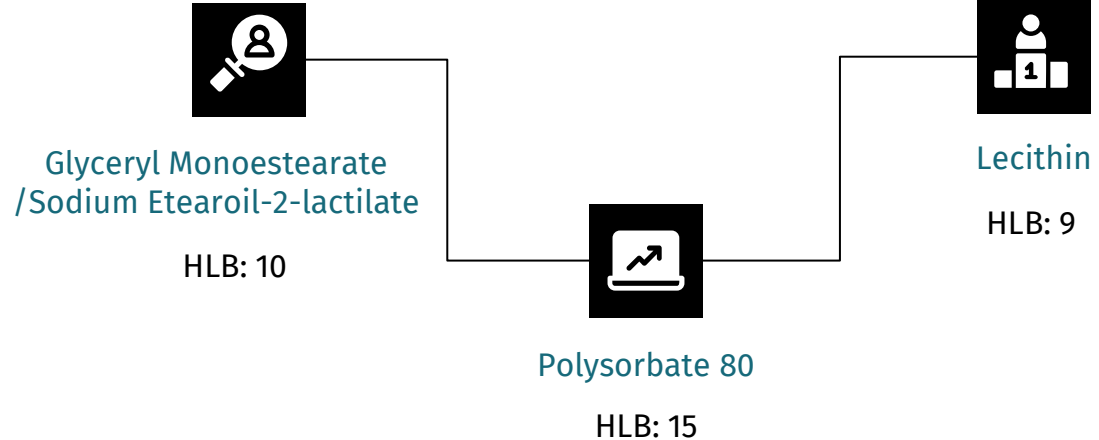
Objective: to enable participants to select an appropriate emulsifier within the context of a product design



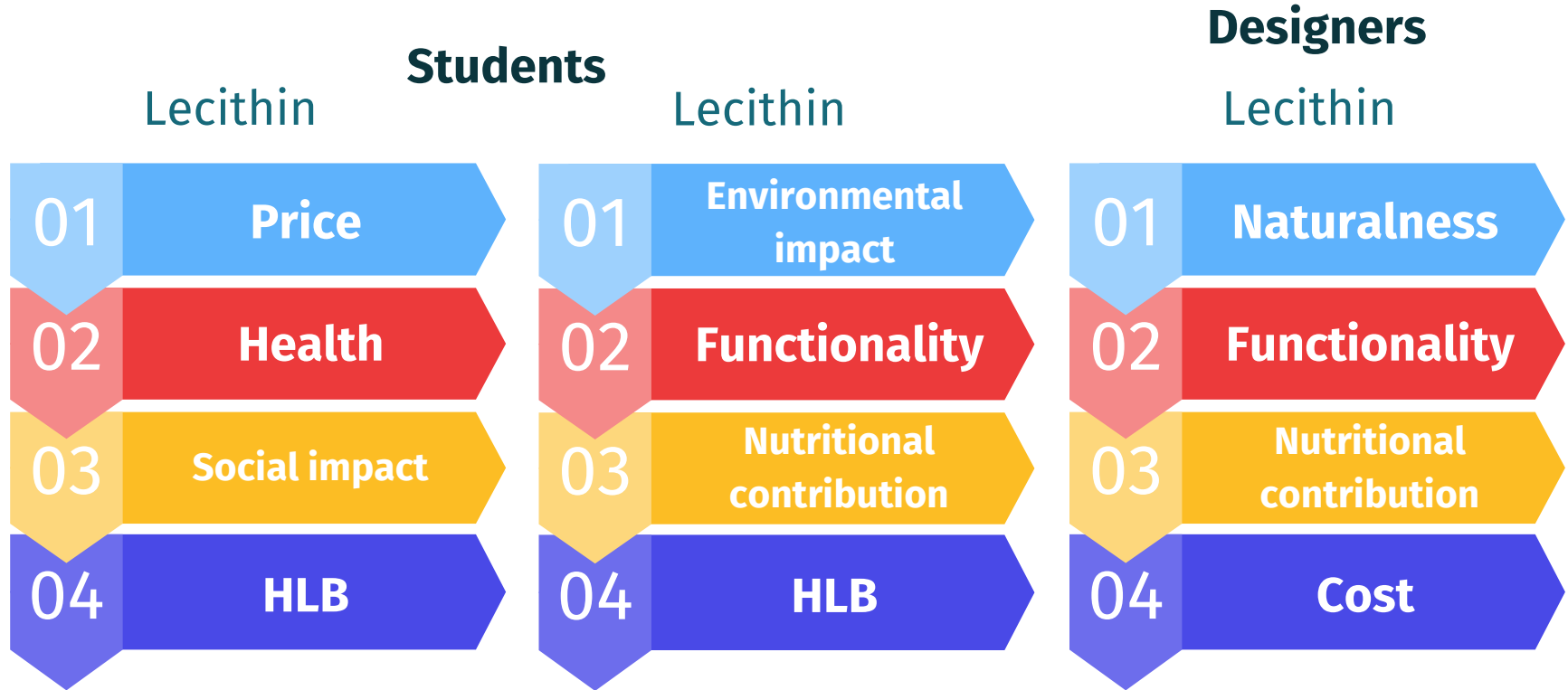


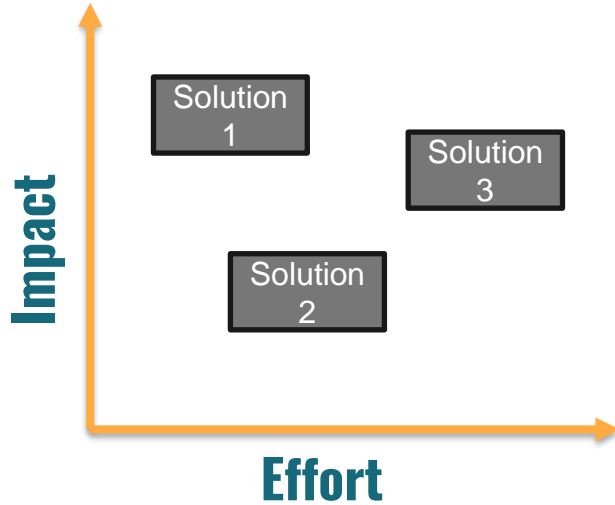
Design of a vegetal beverage, without milk or added sugars.

Selection of emulsifier



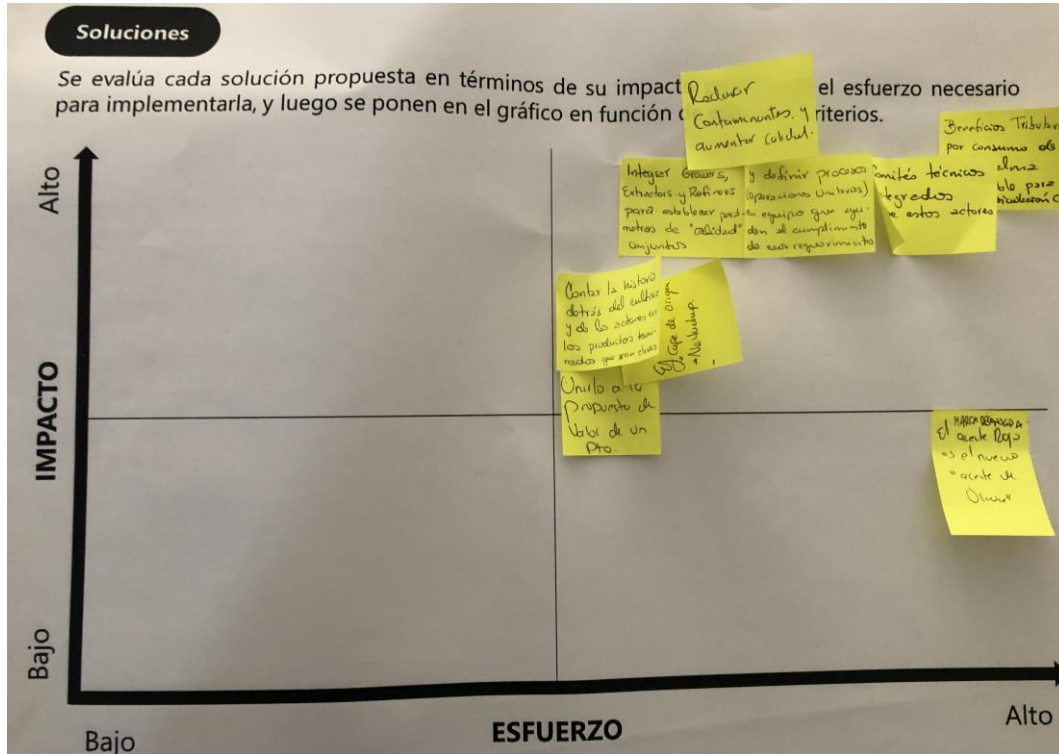
Case of study: Results





- **Objective:** Engage participants in the exploration of value chain limitations and potential solutions.
- Participants are encouraged to suggest improvements and innovative strategies to overcome specific challenges in the value chain.
- Then organize these ideas based on two key parameters: the effort required to implement the solution, and the potential impact of the solution on improving the value chain

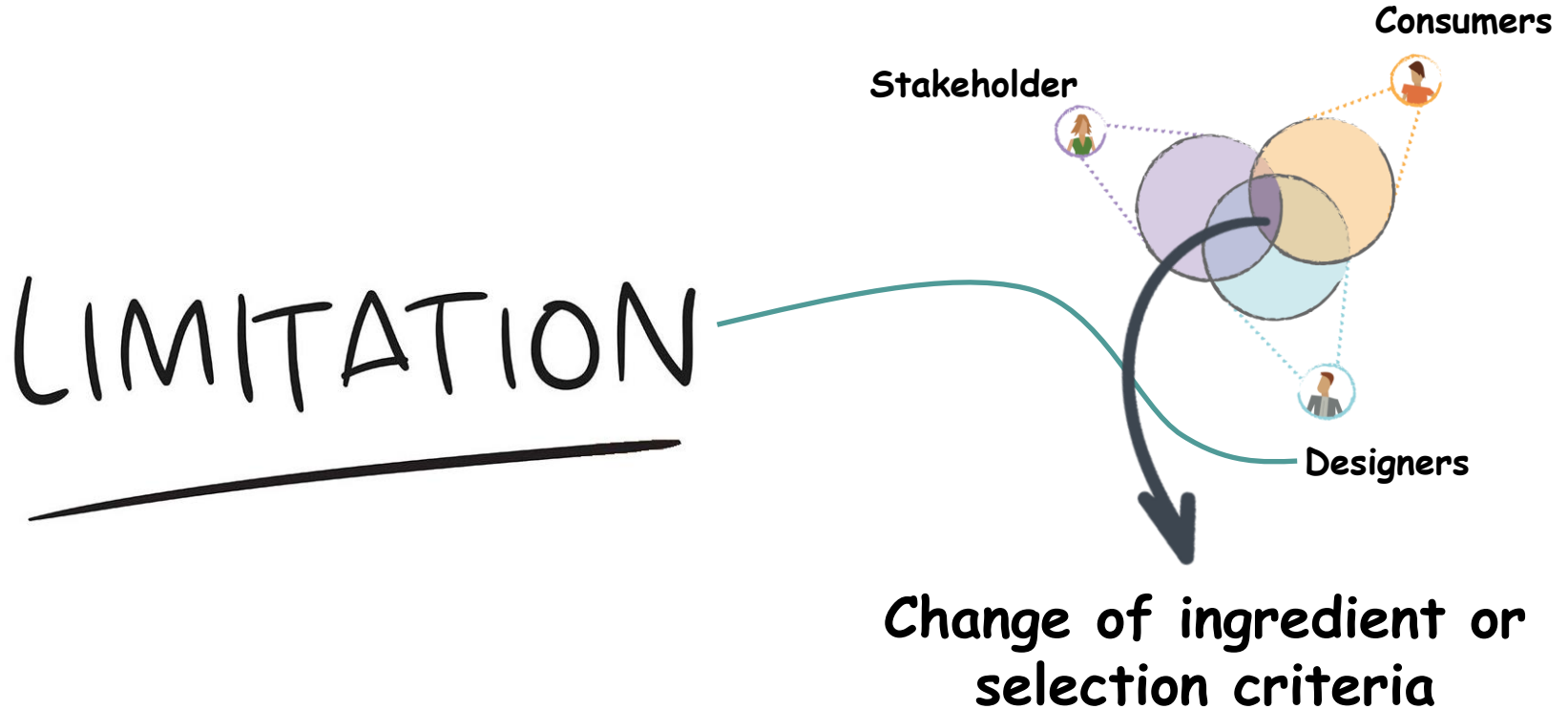
Case of study: Results



Solutions:

- Reduce pollutants and increase quality
- Integrate actors throughout the chain to establish quality parameters.
- To tell the story behind the crop and the stakeholders
- That well-known brands promote the advantages of raw materials

Objective: Include the value chain limitations in the product design



Case of study: Results

Previous: Lecithin

New Choice: Polysorbate 80



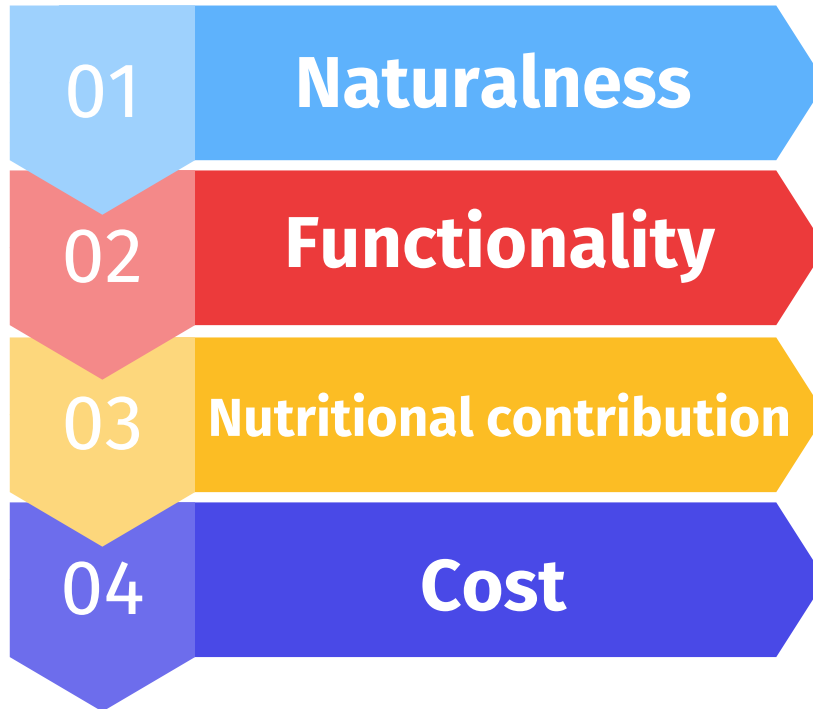
Previous: Lecithin

New Choice: Glyceryl monostearate



Case of study: Results

Designers
Lecithin



No change due to the low amount of emulsifier, but they indicated that with a product that is not so natural, and that the ingredient has a greater impact, the choice and selection criteria could have changed

Conclusions

- The methodology showed its potential to integrate the two scales
- The product design workshop allows us to identify that the participants involved, after knowing the context of the value chain and its limitations, in some cases change their ingredient and sometimes change their priorities in the selection criteria, the designers did not change their selection due to the low amount of emulsifier in the scenario selected.
- A product with another interests and in which the ingredient has a greater impact in terms of quantity, the choice and selection criteria could have changed.

Thanks

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