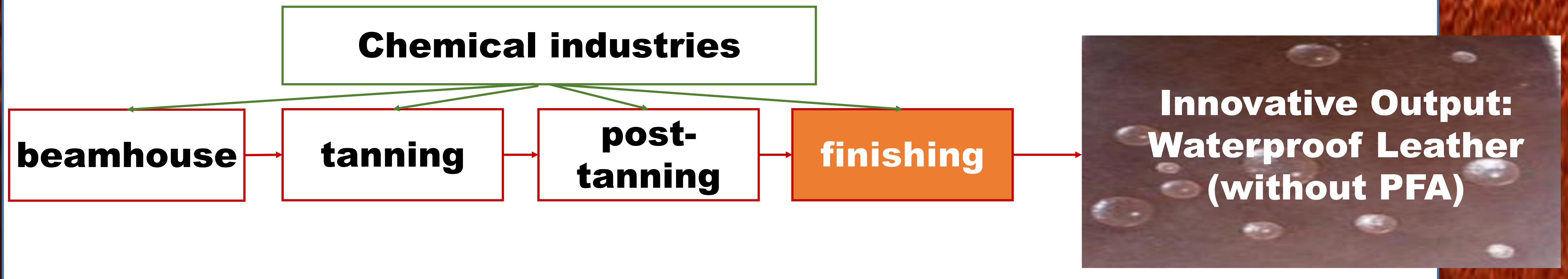


# THE LIFE CYCLE APPROACH TO ASSESS THE SUSTAINABILITY OF AN INNOVATIVE CHEMICAL FORMULATION

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## PROCESS STEPS IN LEATHER MAKING



Tanneries consume about 130 types of chemicals, many of which are considered dangerous for environment and human health. It is therefore clear that the sustainability of tannery production system is influenced by the supplying chemical industry



**GOAL:**  
analyse the environmental and economic issues of an innovative silica-based formulation using Life Cycle Assessment and Life Cycle Costing to predict the hot spots before large scale industrialization stage

### Innovative waterproof nano-based formulation for finishing application

To propose a more sustainable alternative to PFAs an innovative chemical based on nanomaterials, an emergent keystone technology, was developed. The research group evaluated the environmental cost-effectiveness at the pilot plant level



### Economic

### Environmental

#### LCC

No Standard

LCA-type LCC assessment and value-added approach were considered the most suitable to evaluating physical life cycle product in economic terms. Values were obtained through matrix algebra by adding the direct variable costs of the phase with the cost of inputs acquired from other process units. The simple sum of the cost along the life cycle phases of innovation would incur in double counting..  
→ Value added approach

#### LCA

Standard: ISO14040 - 14044

The most impacting phase is represented by the first finishing operation conducted in tannery. Impacts derive by the production of raw material composing the chemical mixture used. Results expressed in terms of damage category showed that the consumption of natural resource, human health and climate change represent the 92.88% of total damage associated with the manufacturing and application of new formulation.

| Phase                  | LCA                      | LCC                         |
|------------------------|--------------------------|-----------------------------|
|                        | Weighing points (mpt/FU) | Unit cost of outputs (€/FU) |
| Waterproof formulation | 20,48                    | 6,7                         |
| 1° Step finishing      | 59,05                    | 0,02                        |
| 2° Step finishing      | 9,01                     | 0,036                       |
| 3° Step finishing      | 11                       | 0,037                       |
| Total                  | 99,54                    | -                           |

LCA and LCC results for every phase associated with production of waterproof formulation necessary to obtain 20 ft<sup>2</sup> of waterproof finished leather.