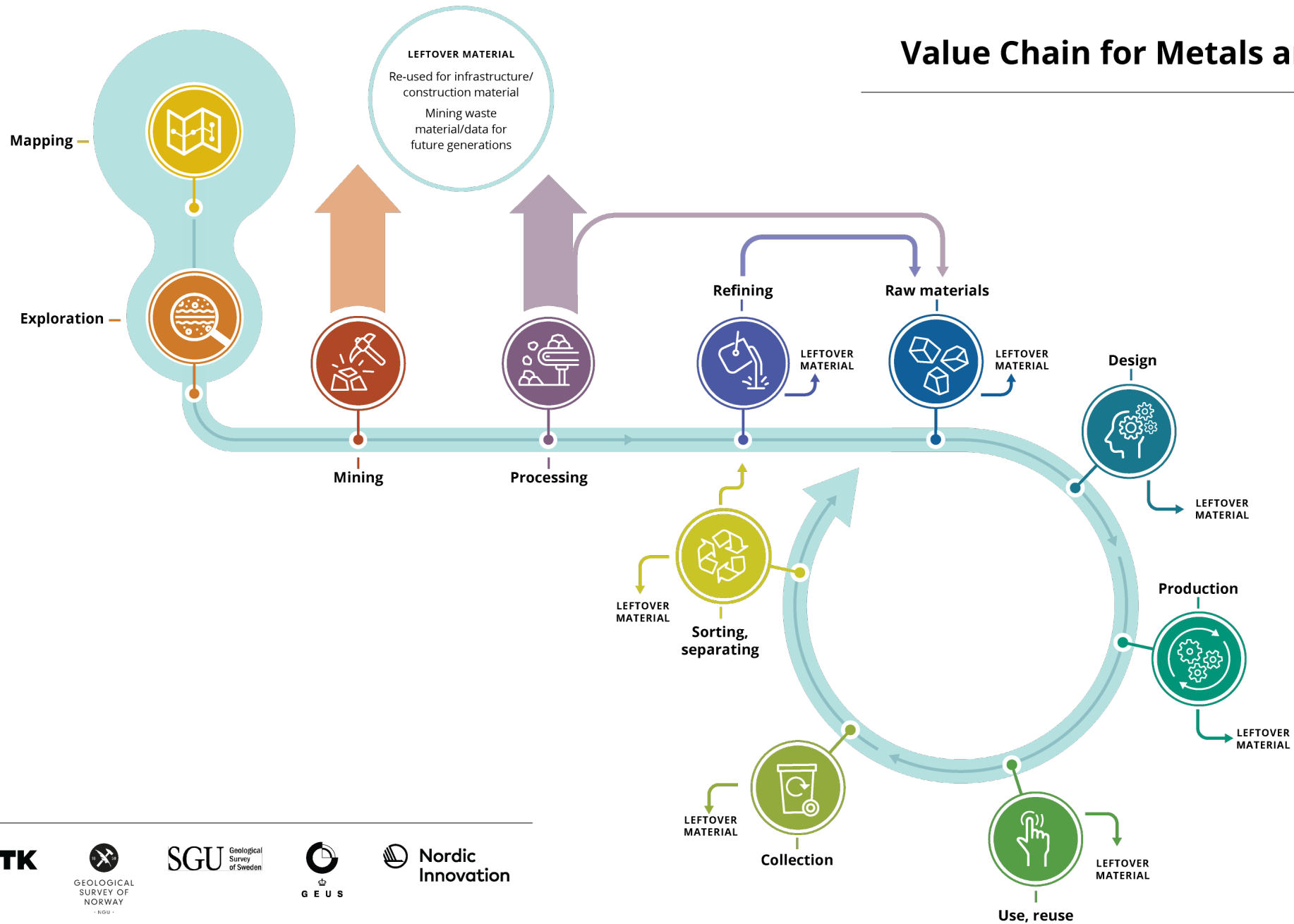


# Value Chain for Metals and Minerals





# Mapping and Exploration

## Mapping

Finding and documenting a mineral deposit is time-consuming. This is usually done by National geological surveys. They provide publicly owned geological data from mapping to reduce economic risk for private companies and minimize environmental impact.

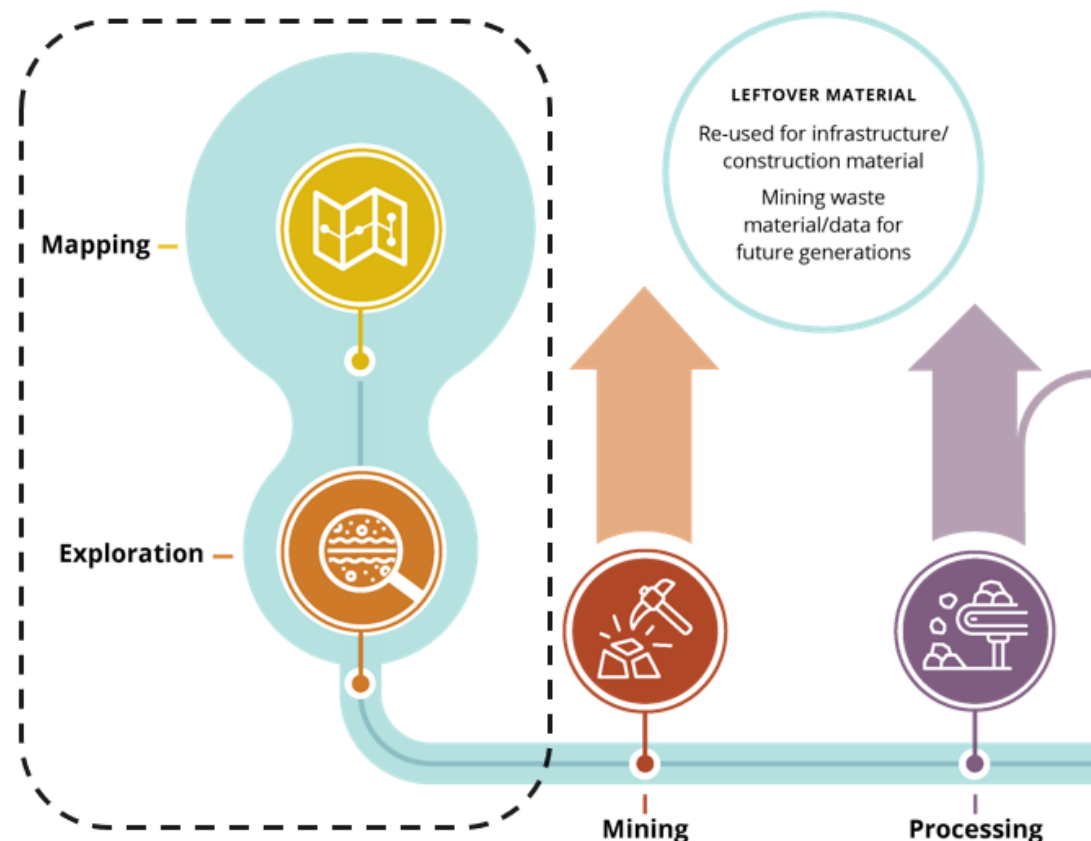
## Exploration

Exploration is targeted activities based on the mapping. It includes a range of activities to help determine the commercial viability of the mineral deposits.

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Only a small number of the mapped and explored deposits goes forward to the mining phase.

The data from both mapping and exploration phases serves the future generations' needs also.





# Mining, Processing and Refining

## Mining

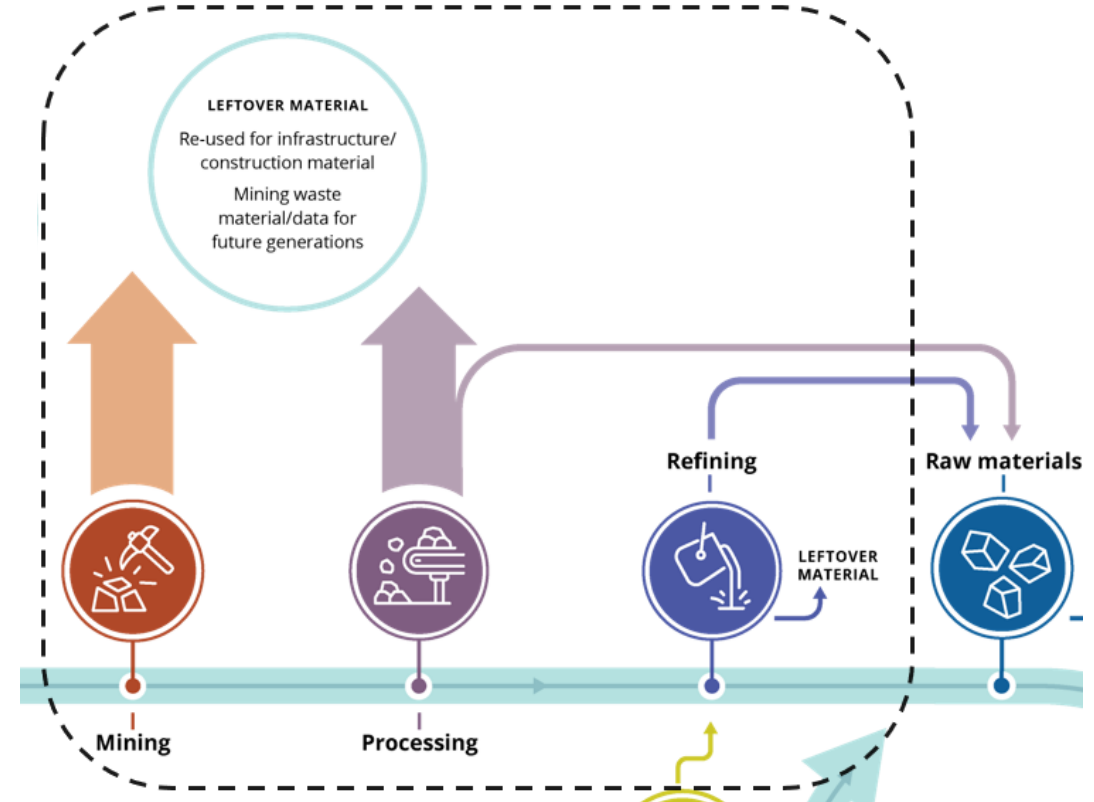
In the mining, the minerals and metals are extracted from the bedrock. Mining processes involve prospecting for ore bodies, analysis of the profit potential of a proposed mine, extraction of the desired minerals and metal, and final reclamation or restoration of the land after the mine is closed.

## Processing

Crushing, grinding, and treating extracted ores to separate valuable minerals and metals from the ore.

## Refining

Purifying extracted minerals to obtain high-purity products suitable for industrial applications (metallurgy).



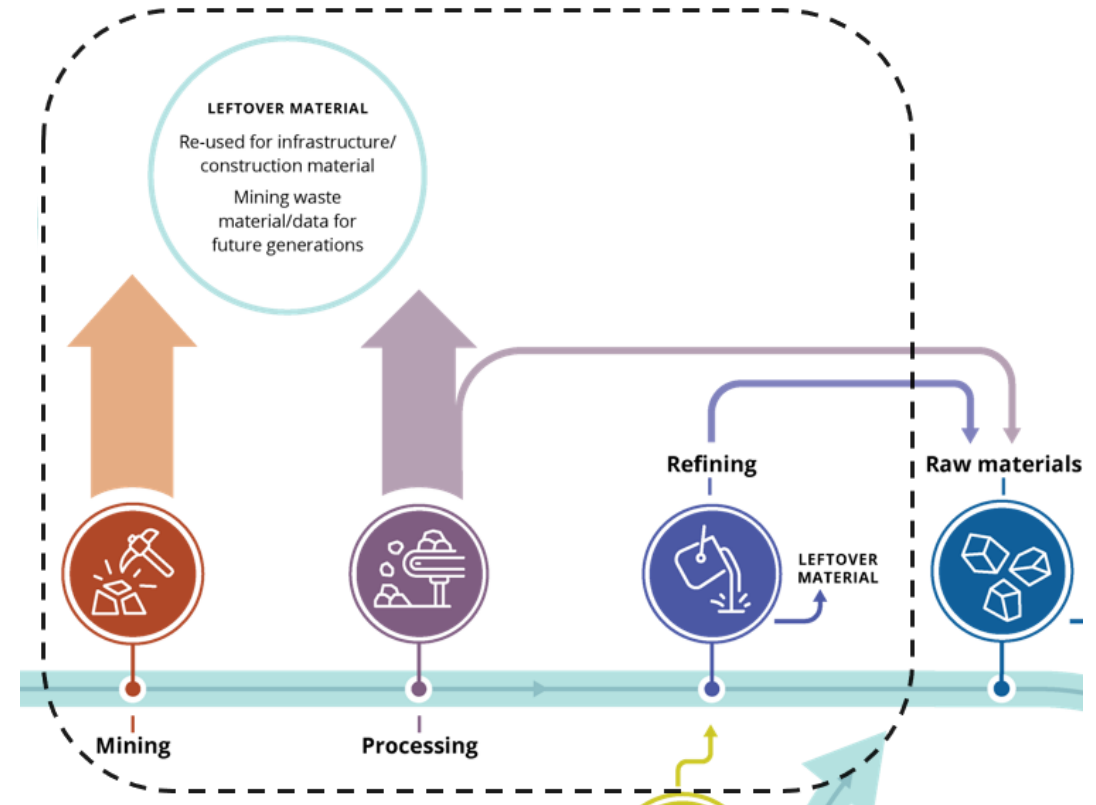


# Design-based circularity is important in mining and processing

Design-based circularity is important already in the mining and processing phases.

Then the mining is done in such a precision that the fractions are kept separated. This is more time-consuming but pays off at the later phases in the value chain.

- Facilitates the utilisation of leftover material. The percentage of the leftover material is high and all the actions leading to easier reuse is beneficial.
- Decreases the amount of the tailings and the material going to refinery. Cost- and energy-efficiency increases when there is less material to process or to handle as leftover material.





# Raw materials, Design, Production

## Raw materials

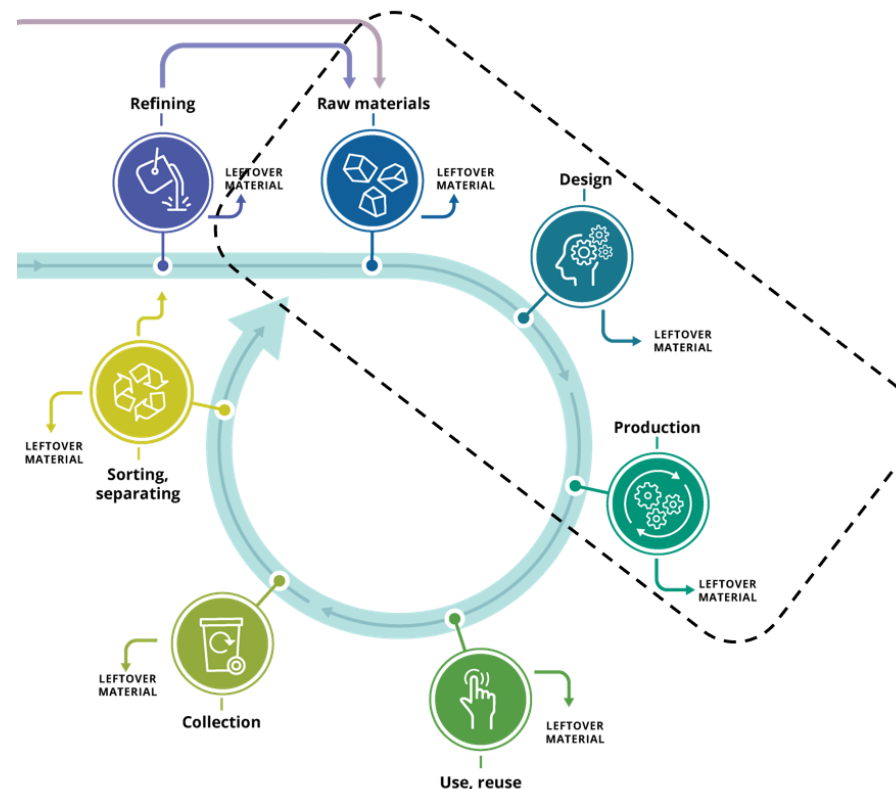
After refining the metals and minerals they are raw materials for design, manufacturing and production.

## Design

Design phase is crucial for the circularity in the next steps of the value chain. In circular design products are designed for long usability, repairability and recyclability.

## Production

Manufacturing products using metals and minerals as key components in various industrial processes.





# Use & reuse, Collection, Sorting & Separating

## Use / reuse

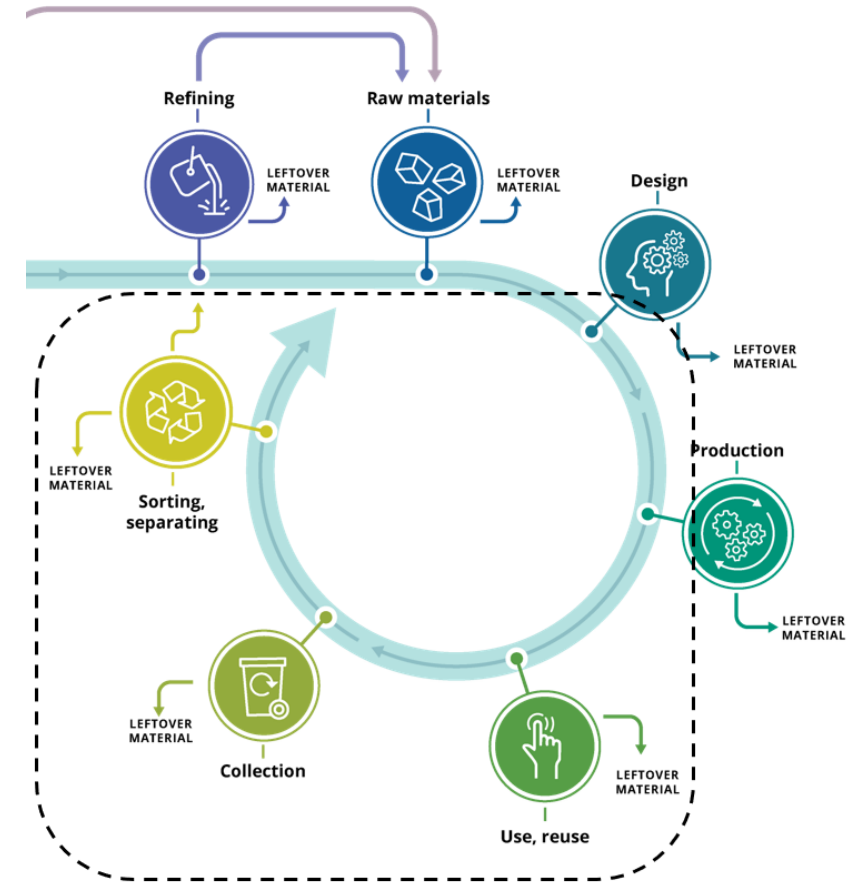
Utilizing manufactured products in consumer or industrial applications and extending their lifecycle through repair, reuse or repurposing.

## Collection

Gathering end-of-life products or waste materials containing minerals for recycling or disposal.

## Sorting

Separating collected materials based on type, quality, and potential for recovery of valuable minerals.



# Leftover materials | Reducing waste – maximising value

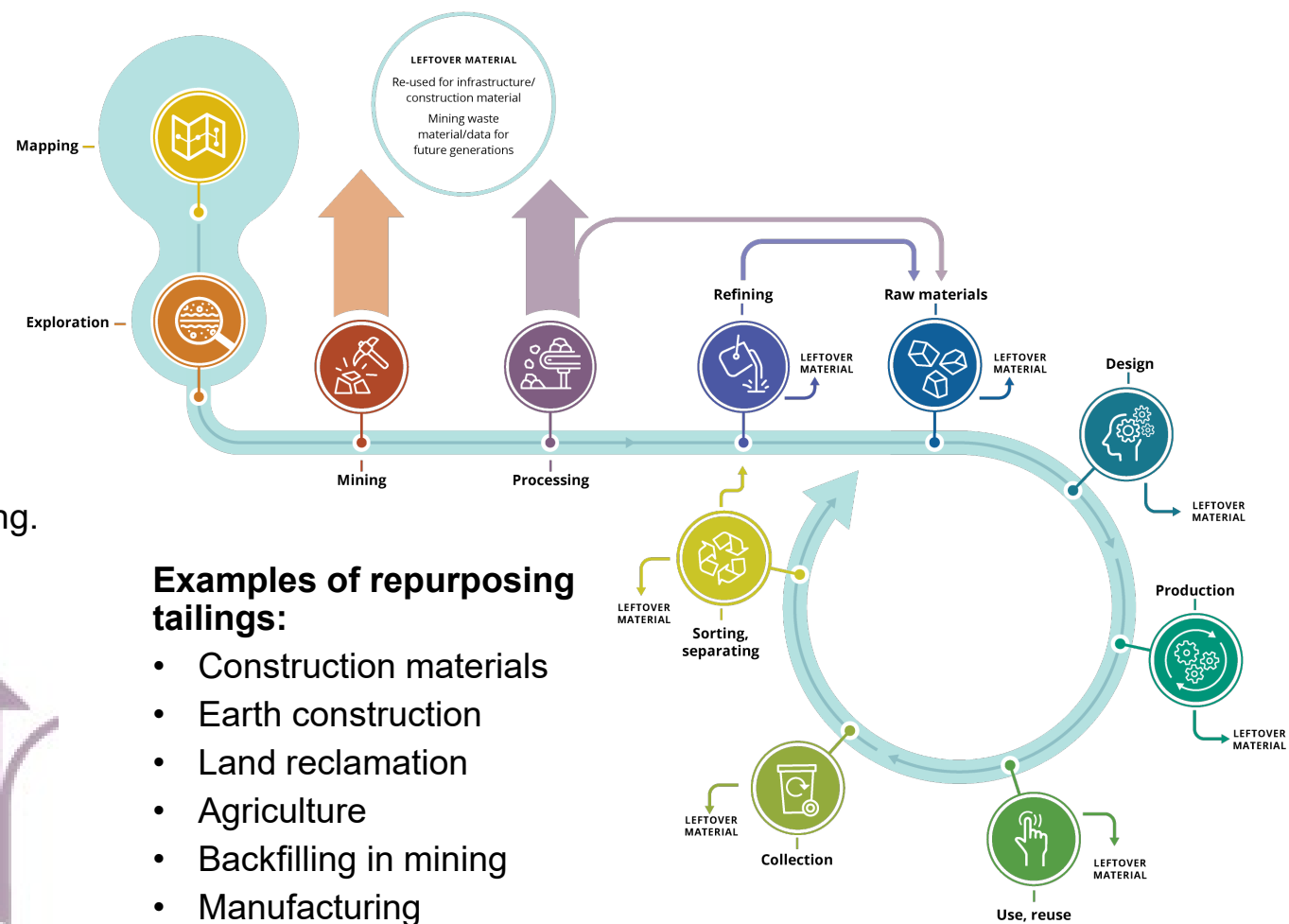
Leftover materials are created in all the value chain phases. The biggest leftover material flow is from mining and processing.

## Repurposing leftover materials

- reduces the need for deposits and virgin materials
- minimizes environmental impact
- is both resource-efficient and economically beneficial.

It decreases the waste management costs and its spatial footprint.

Design-based circularity utilises the material in the value chain and decreases the amount of the leftover material.



## Examples of repurposing tailings:

- Construction materials
- Earth construction
- Land reclamation
- Agriculture
- Backfilling in mining
- Manufacturing
- Water treatment of industrial wastewater
- Energy production
- Recovery of valuable minerals and companion metals/minerals (secondary resources)

# Nordic Sustainable Minerals project

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