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The use of metrics in guiding transformation in resource recovery systems

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Introduction

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CVORR | **Complex Value Optimisation for Resource Recovery**

Novel framework and tool for optimising resource recovery that goes beyond waste management

Overarching goal: To preserve and optimise the value of recovered resources.

- Value in CVORR is four-dimensional including **environmental, economic**, **technical** and **social** metrics.

NERC SCIENCE OF THE ENVIRONMENT

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CVORR Framework

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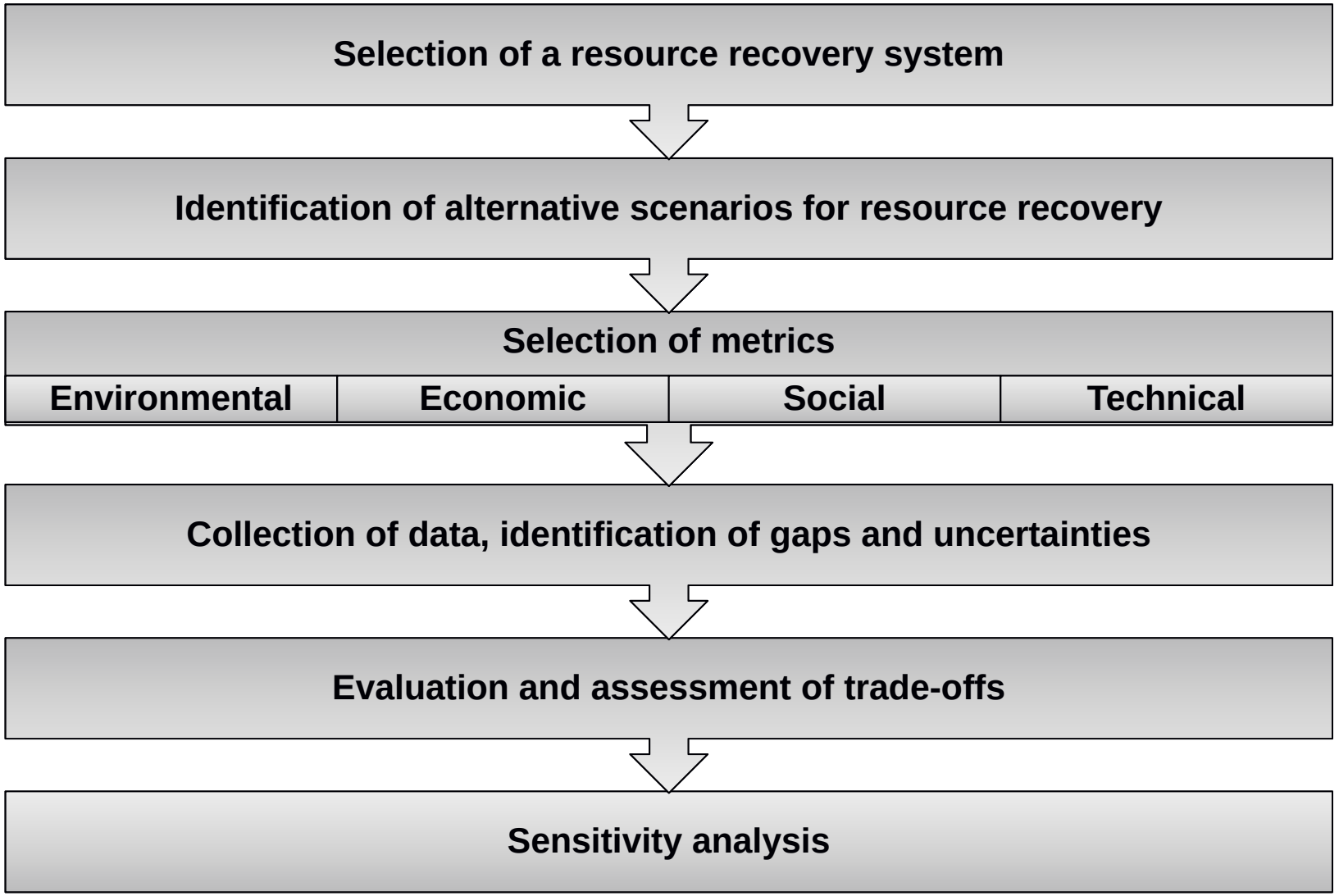

CVORR Framework

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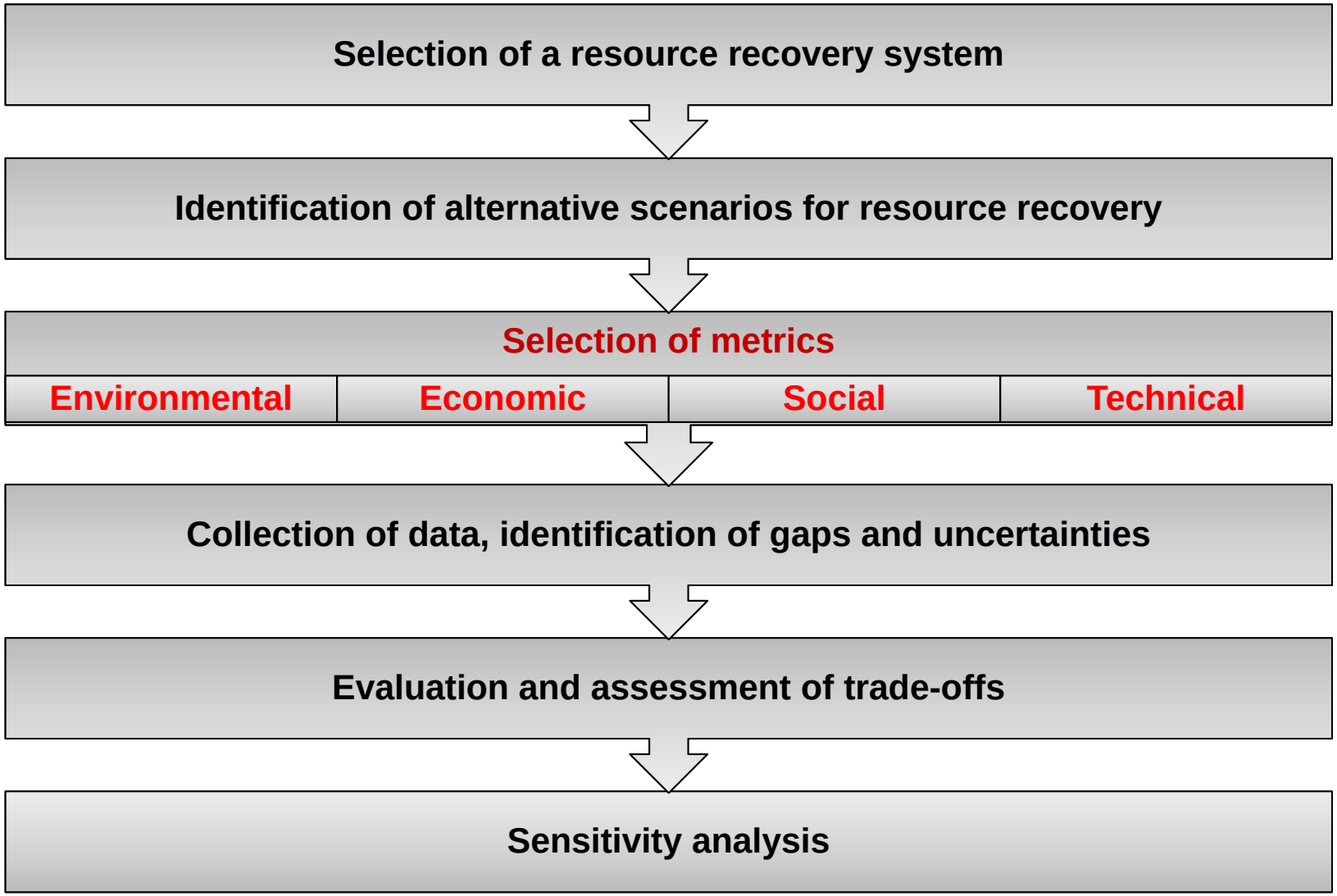

Why do we need metrics?

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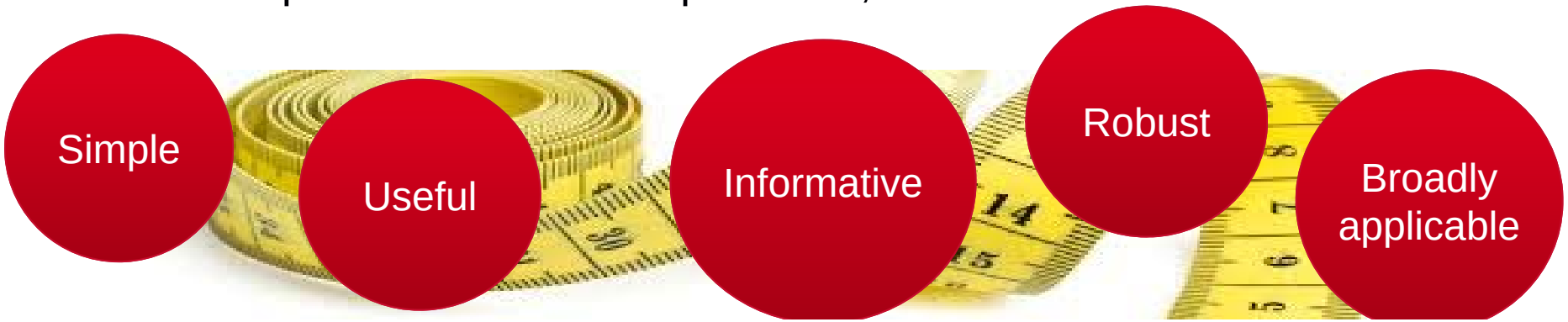
To resolve system inefficiencies and bring transformation…

- Measure values embedded in and associated with the materials, components and products;
- Cut through system complexity and identify hidden environmental, economic, social and technical pressures;
- Assess and evaluate a system's performance;
- Enable robust decision-making, removal of structural barriers and adoption of sustainable practices;



An approach for metrics selection

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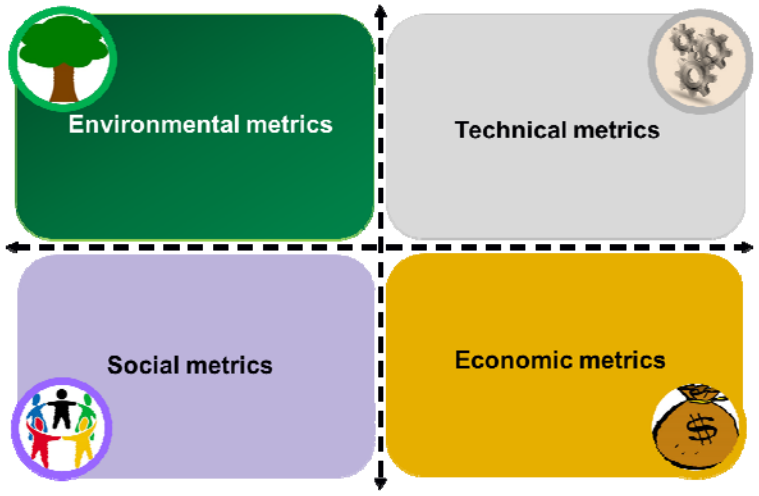
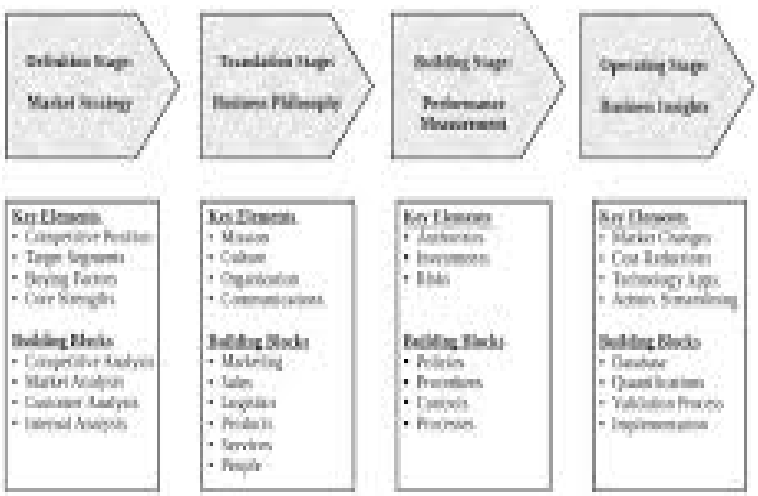
Task 1:

Review and selection of metrics and development of metrics ‘databases’.



Task 2:

Development of metrics selection framework



Task 1: Collection of metrics

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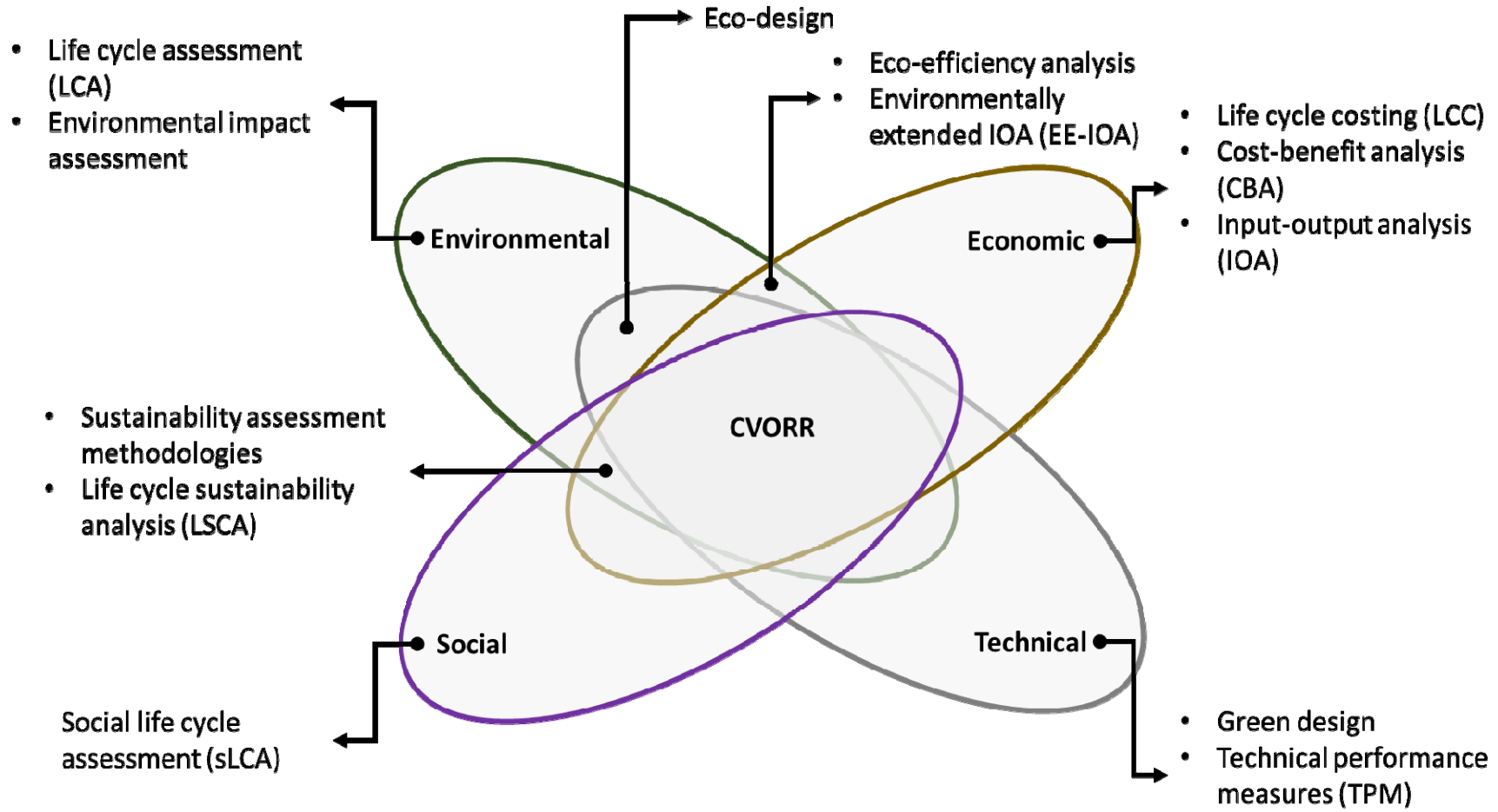

Metric overlaps between different assessment methods and tools

Environmental metrics

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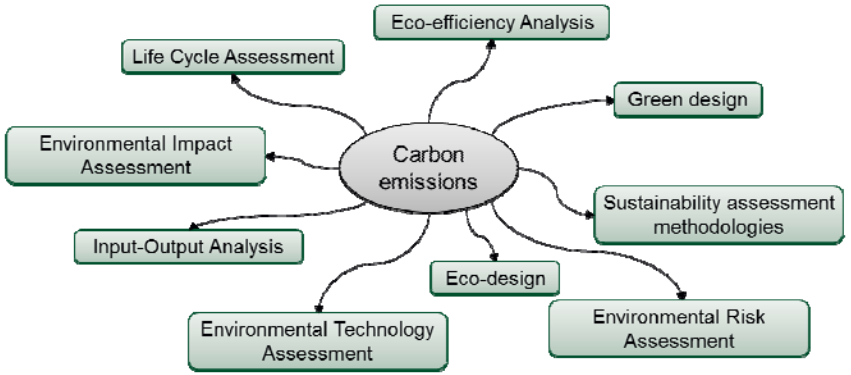
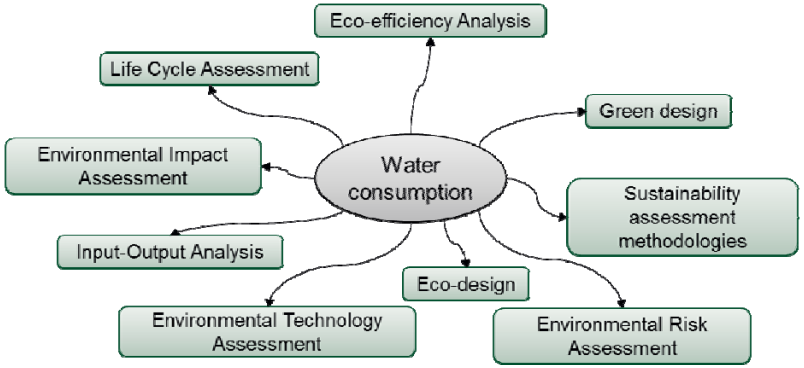
Evaluating impacts on air, soil, water, resource consumption and conservation, as well as human health and ecosystems.

Examples of overlaps between different assessment methodologies on:

- GHG emissions (or else carbon emissions)
- Water consumption
- Energy consumption
- Raw material consumption (or else materials used)
- Stratospheric ozone depletion
- Land use
- Waste generation, etc.





Economic metrics

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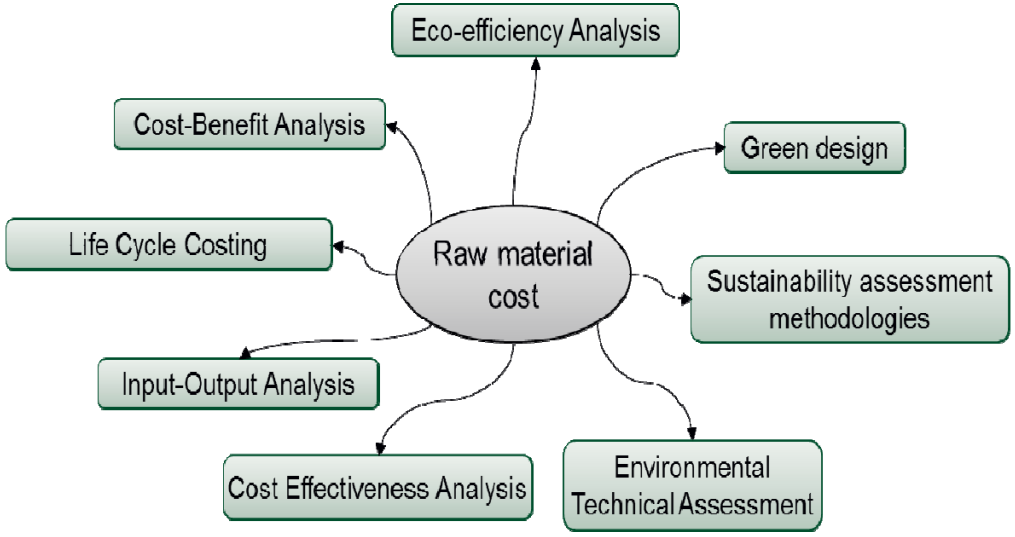
Ensuring an economically sound resource recovery system underpinned by its costs and benefits, as well as its financial limitations and needs.

Examples of overlaps between economic metrics used in resource and waste management assessment methodologies include:

- Raw material costs
- Planning costs
- Acquisition/finance costs
- Purchase costs
- Maintenance costs,
- Revenues
- Subsidies and incentives, etc.



Social metrics

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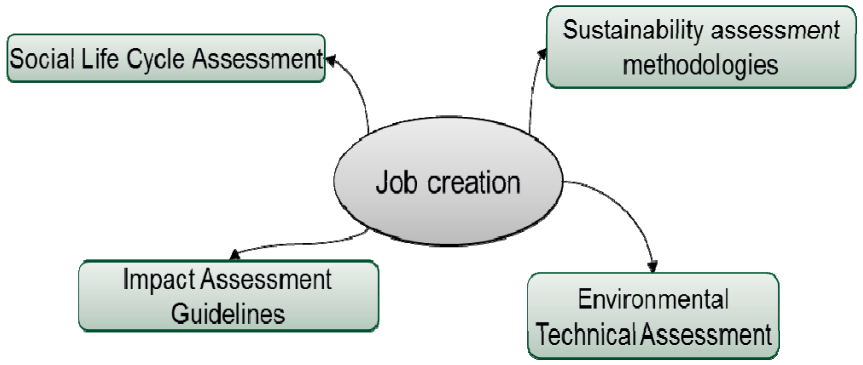
Capturing impacts on a community's cultural values, social services and social cohesion, health & safety, employment, security and education.

Examples of overlaps between social metrics used in resource and waste management assessment methodologies include:

- Jobs creation
- Acceptability of new practices (e.g. source separation)
- Energy security
- NIMBY syndrome
- Noise pollution
- Odour presence
- Child labour
- Health impacts, etc.



Technical metrics

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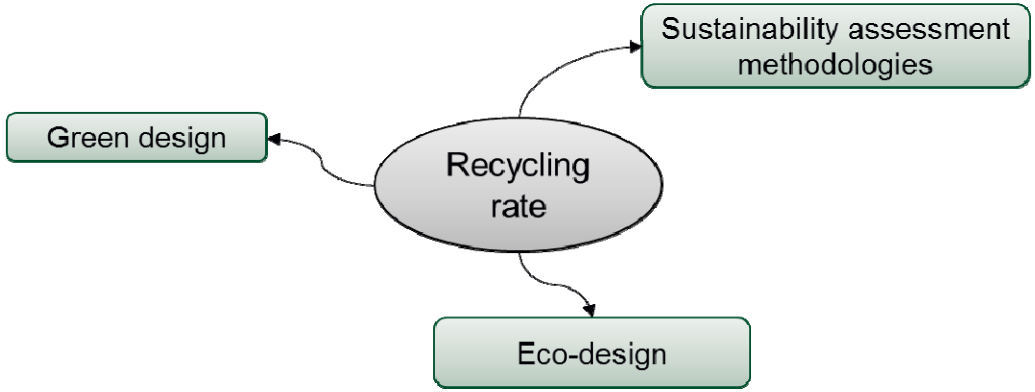
Assessing the technical functionality of resource recovery systems, properties of materials and 'built-in' characteristics of components and products.

Examples of overlaps between technical metrics used in resource and waste management assessment methodologies are only a few due to specificities related to each material, component, or product:

- Recycling rate
- Waste prevention
- Process yield



Task 2: Framework for metrics selection Step 1

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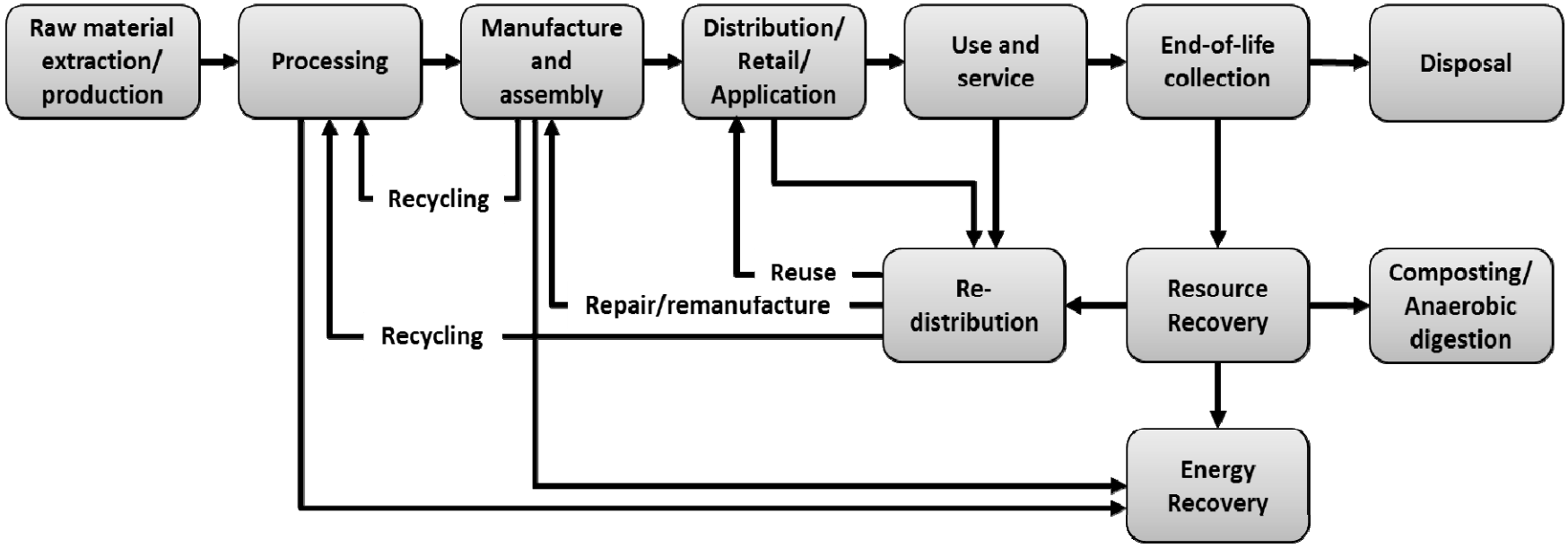
Set out the resource recovery system.

Metrics can vary widely depending on the scope and scale of the resource recovery system.



Metrics not applicable in some resource recovery systems, might be essential in others!!

Step 2

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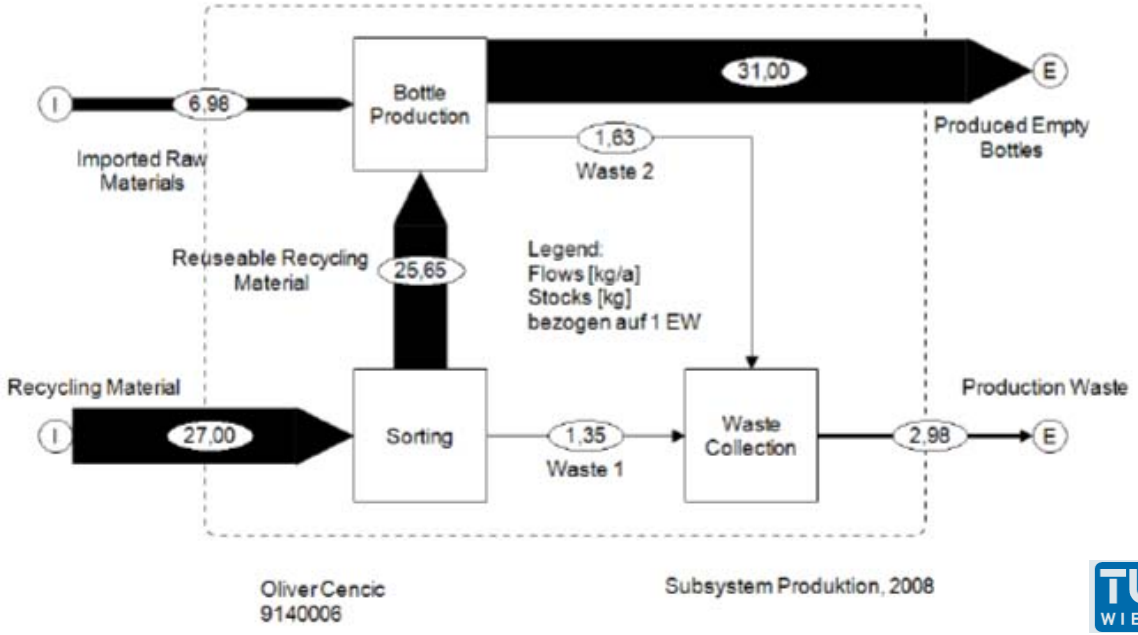
Understand how resources flow and transform through the supply chain system.

At material, component, product level: Material flow analysis (MFA)

To balance resource flows inputs, outputs, stock growth or sinks, and hidden flows (e.g. mining overburden, harvest losses, waste generated upstream, etc.).

At substance level: Substance flow analysis (SFA)

Lifecycle of chemical compounds and transformation into the system.



Step 3

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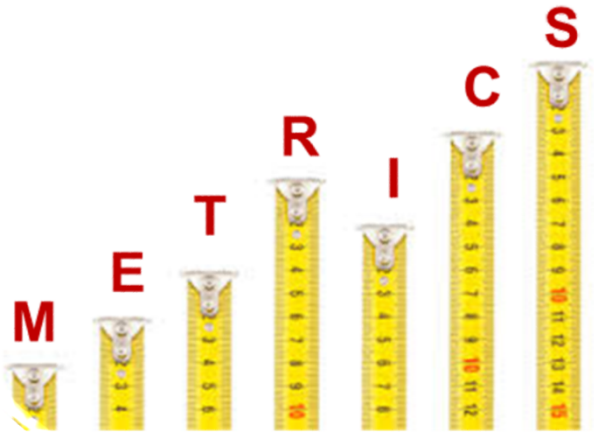
Identify the pressures associated with the resource recovery system.

Climatic conditions, regional and global scalability, the socio-economic and policy landscape, the abundance and/or scarcity of resources, existing infrastructure, human resources, technology interventions and innovation.



Balance between simplification and inclusiveness has to be reached, in order to ensure an effective and transparent analysis of the entire system.

Step 4

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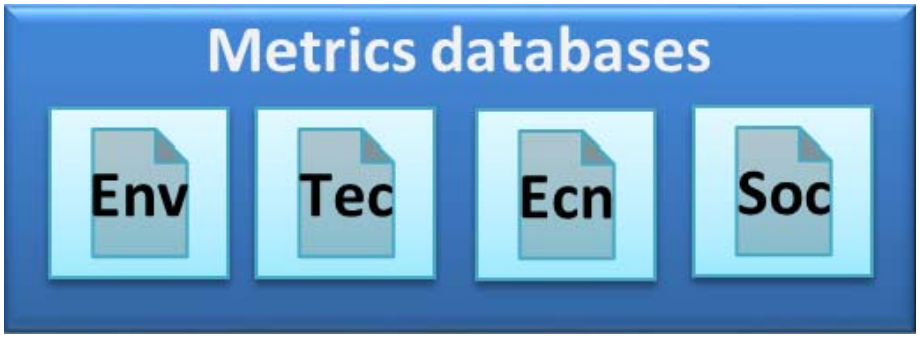
Selection of environmental, economic, social and technical metrics in relation to the resource recovery system in question, bringing together the outputs from previous steps.

Selection is important for the proper assessment of the system.

"Poorly selected metrics can cause performance to deviate from intended goals."

- Atlee and Kirkchain, 2006



Metrics selection depends on the user, using outputs from previous steps.

Key considerations…next steps

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- Metrics are critical for the successful use of the tool – composite metrics not included as they are unlikely to be used efficiently and difficult to replicate;

- Overlaps indicate metrics that are universally pertinent and commonly accepted – but CAUTION these might not always be the metrics that are most meaningful….
  - Proper assessment of each metric's potential to provide useful and meaningful information is required;
  - Development of new ones if and where needed.

- Assessment of the potential of using metrics in guiding transformation in resource recovery systems – a continuously reviewed and revised process.

- Testing of the metrics and framework developed.

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