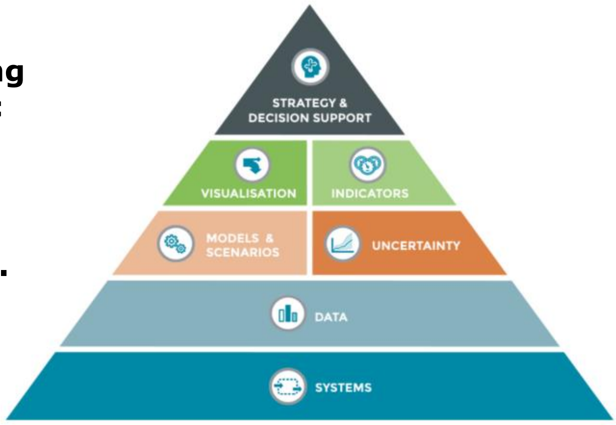
MinFuture

Monitoring the Physical Economy

Robust strategies for sustainable resource management depend on a solid understanding of the physical economy – the anthropogenic stocks and flows of matter and energy.

MinFuture provides a framework for the description and monitoring of the physical economy using Material Flow Analysis (MFA). It distinguishes seven components, which are organised in a hierarchical structure (pyramid).



SYSTEMS

Importance and challenges:

Systems describe where materials are located (stocks) and where they are moving (flows), without quantities.

The knowledge about systems of the physical economy is often highly fragmented, particularly for minor metals, critical raw materials and for end-of-life management.

Key messages:

- Monitoring the system of the physical economy on various scales (site, company, region, country, global) is indispensable for effective resource management and emissions control.

Read more: minfuture.eu/framework/systems

DATA

Importance and challenges:

Data about the physical economy tend to be highly fragmented or lacking entirely.

The reference points of data collected are often unclear (described in words only), which results in ambiguous meaning and misinterpretation of the data.

Key messages:

- Reporting data with their system context ("coordinates") adds clarity and robustness and facilitates data harmonisation.
- Government authorities should consider describing their data with metadata about the system location of the measurements.
  → Monitor systems, not isolated flows

Read more: minfuture.eu/ framework/data

MODELS & SCENARIOS

Importance and challenges:

Models are mathematical representations of material cycles and their drivers. They are used to forecast resource demand and supply and to test strategies under different conditions.

The robustness of models is usually limited by a lack of robust data and system understanding.

Key messages:

- Adding mass and energy balance constraints to resource and emission models enhances the robustness of forecasts.
- Improving system understanding and data quality is the most effective way to improve the quality of forecasts.

Read more: minfuture.eu/ framework/models-and-scenarios

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UNCERTAINTY

Importance and challenges:

A model can never perfectly represent a natural system.

Uncertainties in MFAs are caused by data paucity and errors in system definitions.

Ignoring uncertainty can result in wrong interpretations of the results.

Key messages:

- Uncertainty analysis makes uncertainties transparent and enables users to identify the strengths and weaknesses of the model.
- Systematically evaluating uncertainty enhances the robustness of results and interpretations.

Read more: minfuture.eu/ framework/uncertainty

INDICATORS

Importance and challenges:

Indicators are used to measure the performance of a system or to capture the essence of a system with numbers.

Indicators are often poorly defined.

Strategies to enhance the indicator performance often cause problem shifts.

Key messages:

- The definition of indicators (or indicator sets) can be enhanced through an explicit system definition.
- This adds clarity to the definition and facilitates a robust selection of indicators that capture potential problem shifts.

Read more: minfuture.eu/ framework/indicators

VISUALISATIONS

Importance and challenges:

Visualisations are used to capture the essence of complex systems using images, and to communicate the results in an effective way.

The systems analysed tend to include several dimensions, which are difficult to communicate in words.

Key messages:

- Visualisations can capture multiple dimensions, which add clarity and transparency, and provide interpretations of complex systems.
- Visualisations can be strengthened by integrating different modes of communication (images, words, and numbers).

Read more: minfuture.eu/ framework/visualizations

STRATEGY & DECISION SUPPORT

Importance and challenges:

Resource management strategies tend to be ineffective and shift problems if they are not based on a robust system understanding.

Strategies for monitoring individual aspects of the physical economy tend to be expensive and of limited use for resource strategies if they are not based on an explicit system definition.

Key messages:

- Improving the robustness of the system understanding and the data is the most critical aspect for improving resource strategies.
- MFAs can inform strategies for monitoring the physical economy by providing a language for integrating data and for identifying key points for measurements.

Read more: minfuture.eu/ framework/strategy-and-decision-support

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