# INTEGRATING METRICS OF ENVIRONMENTAL SUSTAINABILITY INTO ECONOMIC EVALUATIONS: A TARGETED LITERATURE REVIEW

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## SUMMARY


- Environmental sustainability is becoming an increasingly relevant and important issue, particularly within the pharmaceutical industry given its substantial impact on climate change
- This targeted literature review aimed to identify existing or nascent economic evaluations to quantify the environmental impact of pharmaceutical practices or therapies, specifically including those used among HTAs
- Several frameworks exist though few are well established and validated; further research is needed to test existing frameworks and develop new ones that can be leveraged by HTAs


## OBJECTIVES

- This study examines how environmental sustainability (ES) metrics have been incorporated into economic evaluations and proposes new innovative methodologies for advancing the integration of ES into these frameworks

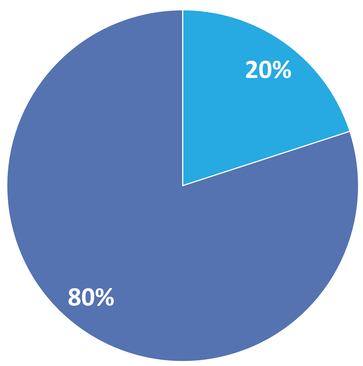
## METHODS

- A targeted literature review was conducted to identify existing approaches to incorporating ES metrics into economic evaluations
- Peer-reviewed articles, conference materials, HTAs, and gray literature were analyzed to synthesize key methodologies and identify gaps in current approaches, focusing on practical implementation and alignment with decision-making priorities

## RESULTS

- A total of eighteen relevant papers were identified from January 2017 to December 2024
- Some existing approaches that HTAs have taken to integrate ES metrics into economic evaluations include:
  - Hybrid cost models that adjust willingness-to-pay thresholds to account for environmental externalities (e.g., carbon emissions)
  - Incremental carbon footprint ratios that quantify trade-offs between environmental and economic outcomes
  - Life cycle analyses (LCA) that leverage scenario-based modeling to evaluate long-term environmental impacts (e.g., waste reduction)
  - Cross-sector or novel modeling approaches

**Figure 1 | Incorporation of Environmental Data by HTAs**



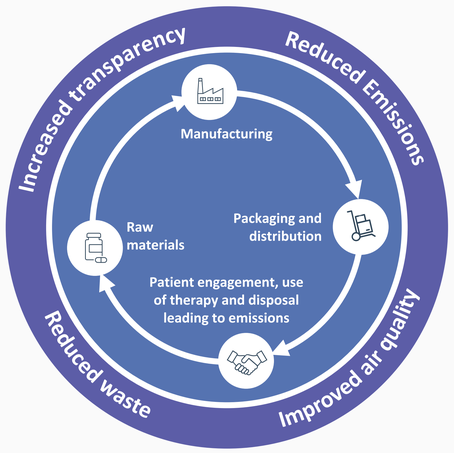

While some HTAs are incorporating environmental data into their overall evaluations, the vast majority do not take environmental data into account. Those that are evaluating environmental aspects are leveraging economic evaluations such as carbon footprint estimations from a life cycle assessment approach.

**Figure 2 | Comparison of Frameworks for HTA Integration**

| Framework | Focus | Strengths | Limitations |
|---|---|---|---|
| Life Cycle Assessment (LCA) | Life cycle emissions | Comprehensive of the entire life cycle | Data-heavy and requires more standardization to make comparisons |
| Multi-Criteria Decision-Making (MCDM) | Multi-domain priorities | Visual and adaptable | Requires subjective weighting |
| Balanced Scorecard | Strategic sustainability | More aligned to corporate goals | Less patient-centric |
| Environmental Impact Assessment (EIA) | Qualitative sustainability | Provides scoping utility | Non-quantitative |
| Indicator Sets | Quantitative metrics | Adaptable across sectors, formula-based | Requires specification for healthcare uses, leading to less standardization |

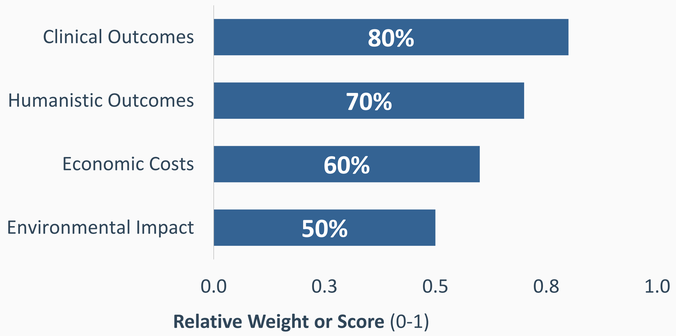
**Figure 3 | Visualizing Environmental Assessment Processes**

**3A. Life Cycle Management in the Pharmaceutical Industry**




Life Cycle Assessments can help monitor and measure progress toward greener initiatives; however, utilization of LCAs is not currently common practice within pharmaceutical companies, partly as a result of inconsistency and inhomogeneity in modelling choices across the industry leading to unreliable results[11]

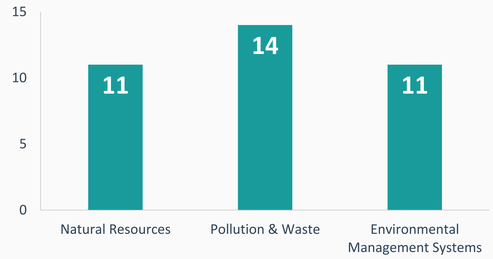
**3B. Multi-Criteria Decision-Making (MCDM) Weighting Example**




This Multi-Criteria Decision-Making model leverages a Sustainability Balanced Scorecard (SBSC) framework, including key dimensions of financial, customer, social, and environmental perspective, as well as internal process and learning and growth perspectives to provide a relative weight to key outcomes, impacts, and costs across clinical, humanistic, and environmental dimensions[10]

**Figure 4 | Structured Quantitative Indicators for Environmental and Social Sustainability within Innovative Environmental and Social Sustainability Framework,** Number of Indicators

**3A. Environmental Indicator Categories[8]**




Natural resources include subcategories of energy, water, materials, and land use and biodiversity. Pollution and waste manage include pollution (e.g., air, water, land) and waste (e.g., hazardous, solid, wastewater). Environmental management system includes eco-design and environmental management

**3B. Social Indicator Categories[8]**


Labor practices include employment, hours of work, diversity among workforce, etc. Health & Safety include occupational health and safety and accidents. Human Rights includes discrimination, disciplinary and security practices, etc. Society includes localization, community, ethics, compliance, etc. Product Responsibility includes customer health and safety, respect for privacy, and customer satisfaction

## DISCUSSION AND CONCLUSIONS

- Though some HTAs have sought to incorporate ES into evaluation metrics, the majority do not yet integrate these metrics given that methods for ES analysis are still maturing.
- Further use and testing of existing evaluations, as well as creation of more codified analytical approaches and tools, could enhance the incorporation of sustainability in HTA evaluation frameworks, making them more accessible to non-experts, and aiding discussions with various stakeholders, including policymakers and patients.
- While these methods highlight the applicability of established HEOR modeling techniques in ES, additional novel methodologies could be considered as the focus on environmental sustainability becomes more prevalent in healthcare.
- Based on these findings, the authors of this research propose the use of "gamified environmental metrics" to address critical gaps by using interactive dashboards that visually simulate trade-offs between clinical, economic, and environmental outcomes in a visual, intuitive way. Future research should focus on operationalizing these methods to optimize clinical, economic, humanistic, and environmental priorities.

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## ABBREVIATIONS

**HTA –** Health Technology Assessment | **ES –** Environmental Sustainability | **SBSC –** Sustainability Balanced Scorecard | **MCDM –** Multi-Criteria Decision-Making | **EIA –** Environmental Impact Assessment | **HEOR –** Health Economics and Outcomes Research | **LCA –** Life Cycle Assessment | **HTA –** Health Technology Assessment | **ES –** Environmental Sustainability

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