JOURNAL OF INDUSTRIAL ECOLOGY

中文摘要
《产业生态学报》
第9卷第4期

翻译
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Chinese Abstracts
Journal of Industrial Ecology
Volume 9, Number 4

Translated by
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题目：生态效率定量分析框架

作者：Gjalt Huppes, Masanobu Ishikawa

关键字： 环境成本效益，环境影响评分，环境强度，环境生产力，产业生态学，双赢

摘要： 生态效率是分析可持续性的重要工具，它阐明了经济活动的环境影响及环境价值间的经验关系——社会为保证一定的环境质量愿付出经济代价。经济与环境的关系不处于微观层面，也不是社会所有微观决策的宏观加合，所以不那么简单明了。澄清运用生态效率的原因及内涵是实现宏观与微观可持续决策的第一步。主要分析框架确定之后，需要通过建模描述实际的经济与环境关系。现有多种方法集成不同类型的环境影响，它们之间存在着部分重复，必须进一步加以澄清。另外，一些生态效率指标的分子分母放大问题也影响着生态效率的广泛应用，需要进行标准化处理。理论方法与现实决策相结合的问题也必须慎重处理。最后，生态效率的一些细节，如优缺点及局限的仍有待深入讨论。

A Framework for Quantified Eco-Efficiency Analysis

Gjalt Huppes and Masanobu Ishikawa

KEYWORDS:

environmental cost-effectiveness, environmental effect score, environmental intensity, environmental productivity, industrial ecology, win-win

SUMMARY:
Eco-efficiency is an instrument for sustainability analysis, indicating an empirical relation in economic activities between environmental cost or value and environmental impact. This empirical relation can be matched against normative considerations as to how much environmental quality or improvement society would like to offer in exchange for economic welfare, or what the trade-off between the economy and the environment should be if society is to realize a certain level of environmental quality. Its relevance lies in the fact that relations between economy and environment are not self-evident, not at a micro level and not at the macro level resulting from micro-level decisions for society as a whole. Clarifying the why and what of eco-efficiency is a first step toward decision support on these two aspects of sustainability. With the main analytic framework established, filling in the actual economic and environmental relations requires further choices in modeling. Also, the integration of different environmental effects into a single score requires a clear definition of approach, because several partly overlapping methods exist. Some scaling problems accompany the specification of numerator and denominator, which need a solution and some standardization before eco-efficiency analysis can become more widely used. With a method established, the final decision is how to embed it in practical decision making. In getting the details of eco-efficiency better specified, its strengths, but also its weaknesses and limitations, need to be indicated more clearly.

题目：生态效率及其术语

作者：Gjalt Huppes, Masanobu Ishikawa

关键字：环境强度，环境生产力，环境改善成本，环境成本效益，产业生态学，词典

摘要：生态效率着眼于创造价值的同时减少环境影响。不考虑此概念的规范性作用，生态效率在实践中可定义为环境影响与经济成本或价值的比值。定义时面临两个基本的选择：分子及分母上的变量为何；是否详细区分环境影响与环境改善及创造的价值与成本。实际操作中，通过区分一般的环境价值创造和特别的环境改进努力，将分子、分母的选择权留给用户，发展出了多种环境效率的表述法，最基本的四类包括：基于实际价值的环境强度与环境生产力，以及侧重于环境改进措施的环境改善成本和环境成本效益。

Eco-efficiency and Its Terminology

Gjalt Huppes and Masanobu Ishikawa

KEYWORDS:

environmental intensity, environmental productivity, environmental improvement cost, environmental cost-effectiveness, industrial ecology, lexicon

SUMMARY:

Eco-efficiency has been defined as a general goal of creating value while decreasing environmental impact. Leaving out the normative part of this concept, the empirical part refers to a ratio between environmental impact and economic cost or value. Two basic choices must be made in defining practical eco-efficiency: which variable is in the denominator and which is in the numerator; and whether to specify environmental impact or improvement and value created or cost. Distinguishing between two situations, the general one of value creation and the specific one of environmental improvement efforts, and leaving the numerator-denominator choice to the user, as diverging practices have developed, four base types of eco-efficiency result: environmental intensity and environmental productivity in the realm of value creation; and environmental improvement cost and environmental cost-effectiveness in the realm of environmental improvement measures.

题目：企业可持续资本的成本与可持续价值创造

作者：Frank Figge, Tobias Hahn

关键字：英国石油公司(BP)，生态效率，产业生态学，自然资本，机会成本，可持续性指标

摘要：本文发展并应用了一套方法，可以用来计算企业使用可持续性资本的成本以及可持续价值创造能力。可持续发展理论认为，企业决策时除经济资本之外还必须考虑其它各类资本。金融经济学中的资本成本表现为选定一类投资而无法进行其它投资所造成的机会成本，资本的收益必须高于资本的成本。本文借用了机会成本理论并加以扩展，用于评价其它非经济资本。由此可以(1)综合评价分析各种不同的资本；(2)确定企业多种资本的机会成本，即企业的可持续性资本成本；(3)计算企业的可持续性效率；(4)计算可持续价值创造，即超出可持续性资本成本之外的那部分收益。论文将金融市场领域内的已经发展成熟的经济资本理论应用于非经济资本领域，论证了如何进行可持续性资本分配，从而最大程度地创造企业的可持续价值。本文最后通过英国石油公司的可持续表现评价案例证明了所述方法的实用性。

The Cost of Sustainability Capital and the Creation of Sustainable Value by Companies

Frank Figge and Tobias Hahn

KEYWORDS:
British Petroleum (BP), eco-efficiency, industrial ecology, natural capital, opportunity cost, sustainability indicators

SUMMARY:
We develop and apply a valuation methodology to calculate the cost of sustainability capital, and, eventually, sustainable value creation of companies. Sustainable Development posits that decisions must take into account all forms of capital rather than just economic capital. We develop a methodology that allows calculation of the costs that are associated with the use of different forms of capital. Our methodology borrows the idea from financial economics that the return on capital has to cover the cost of capital. Capital costs are determined as opportunity costs, that is, the forgone returns that would have been created by alternative investments. We apply and extent the logic of opportunity costs to the valuation not only of economic capital but also of other forms of capital. This allows (a) integrated analysis of use of different forms of capital based on a value-based aggregation of different forms of capital, (b) determination of the opportunity cost of a bundle of different forms of capital used in a company, called cost of sustainability capital, (c) calculation of sustainability efficiency of companies, and (d) calculation of Sustainable Value creation, that is, the value above cost of sustainability capital. By expanding the well-established logic of the valuation of economic capital in financial markets to cover other forms of capital we provide a methodology that allows determination of the most efficient allocation of sustainability capital for sustainable value creation in companies. We demonstrate the practicability of the methodology by the valuation of the sustainability performance of British Petroleum (BP).

题目：运用数据包络分析衡量生产活动的生态效率

作者：Timo Kuosmanen, Mika Kortelainen

关键字：活动分析，集成，环境表现，环境压力，公路交通，权重限制

摘要：生态效率评价的难点在于用单一的环境损害指标综合各种不同的环境压力。本文论述了如何通过数据包络分析法(DEA)完成上述任务。DEA 侧重于分析不同自然资源间和污染排放间的替代可能性，无需进行主观的或规范的权重判断，尽管该方法能够包括一些软性的权重限制。本文利用该法分析了芬兰东部三大城市间公路交通的生态效率情况。

Measuring Eco-efficiency of Production with Data Envelopment Analysis

Timo Kuosmanen and Mika Kortelainen

KEYWORDS:

activity analysis, aggregation, environmental performance, environmental pressures, road transportation, weight restrictions

SUMMARY:

Aggregation of environmental pressures into a single environmental damage index is a major challenge of eco-efficiency measurement. This article examines how the data envelopment analysis (DEA) method can be adapted for this purpose. DEA accounts for substitution possibilities between different natural resources and emissions and does not require subjective judgment about the weights. Although DEA does not require subjective or normative judgment, soft weight restrictions can be incorporated into the framework. The proposed approach is illustrated by an application to assessing eco-efficiency of road transportation in the three largest towns of eastern Finland.

题目：可持续性平衡计分卡——生态效率分析框架之一

作者：Andreas Möller, Stefan Schaltegger

关键字：生态效率，环境信息系统，产业生态学，策略管理，策略地图，可持续性指标

摘要：为成功的决策提供有益的支持，管理者需要综合衡量所有财务和非财务因素，来放映不同的需求、目标、策略、资源、性能及这些要素间的因果关系。平衡记分卡提供了这样一套开放式的评价系统。但用于描述各类可持续性影响因素的改进型平衡记分卡需要一些新型的数据支持，这要诉诸于生态效率分析。

本文讨论了可持续性平衡计分卡及生态效率分析间的关系。生态效率分析是可持续性平衡计分卡的数据基础。此外，平衡计分卡及企业环境会计系统通过环境信息系统加以联系，而生态效率分析作为环境信息系统的重要组成部分，正是实现上述联系的关键。本文就此展开了论述，研讨的重点在于因果关系原理、作用形式及其对企业信息系统组成模块设计的意义。

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The Sustainability Balanced Scorecard as a Framework for Eco-efficiency Analysis

Andreas Möller and Stefan Schaltegger

KEYWORDS:

eco-efficiency, environmental information systems, industrial ecology, strategic management, strategy maps, sustainability indicators

SUMMARY:
To provide valuable support for successful decision-making, managers need a balanced set of financial and nonfinancial measures that represent different requirements, strategic goals, strategies, resources, and capabilities and the causal relationships between these domains. The balanced scorecard is such a measurement system. As an open system the balanced scorecard facilitates the consideration of sustainability issues. But enhanced balanced scorecards require a new type of data. This is where eco-efficiency analysis comes into play.

This article discusses the relationship between so-called sustainability balanced scorecards and eco-efficiency analysis. Eco-efficiency analysis not only provides a data source for sustainability balanced scorecards; in the perspective of environmental information systems it also serves as a link between the balanced scorecard and corporate environmental accounting systems so that eco-efficiency as a component of an environmental information system becomes an adapter with two faces, which are characterized in this article. The main focus is on the principle of cause and effect, its different forms, and the implications for the design of appropriate information system components.

题目：采用不同加权方法的生态效率改进的供应曲线

作者：Evert Nieuwlaar, Geert Warring, Corjan Brink, Walter Vermeulen

关键字：大气排放，企业环境策略，生态效率，油气制造业

摘要：生态效率旨在以最小的成本实现环境改进。根据单位环境改进的成本，可对多种环境影响排序，由此采取相应的生态效率措施，以最小的代价实现预期的环境改进。这一过程描述了累积成本（或单位改进成本）与累积环境改进间的关系，可通过环境改进的供给曲线加以图示。基于某荷兰油气制造公司的各类可能环境改进措施，本文绘制了这样的供给曲线。

通过加权衡量某一特定措施的所有环境影响，可最终确定环境改进的效果。本文尽可能广泛地比较了五种环境影响的加权方法。除目标距离法之外，其它四类方法下的供给曲线差别不大，但不同改进措施的排序结果却大为不同。因而，有限环境预算下根据不同权重体系制定的措施必然有所差异。以氮氧化物为例，具体减排多少极大地取决于权重体系的选择。

Supply Curves for Eco-efficient Environmental Improvements Using Different Weighting Methods

Evert Nieuwlaar, Geert Warring, Corjan Brink, and Walter Vermeulen

KEYWORDS:

atmospheric emissions, corporate environmental strategy, eco-efficiency, oil and gas producing industry

SUMMARY:

Eco-efficiency implies environmental improvement at the lowest possible cost. When several environmental measures are possible, these can be ranked according to their cost per unit of environmental improvement, after which an eco-efficient set of measures can be selected that yields a given level of environmental improvement at least cost. This procedure can be visualized as a supply curve for environmental improvement. Such a curve plots cumulative cost or cost per unit of environmental improvement against cumulative environmental improvement, with measures ordered according to increasing cost per unit of environmental improvement. This paper presents supply curves for environmental improvement on the basis of a set of possible environmental measures for a company in the Dutch oil and gas producing industry.

To measure aggregated potential environmental improvement for a given measure, different environmental impacts are lumped together using weighting factors. We compare five methods for weighting environmental impacts, covering a wide range of current practices.

The supply curves that were determined for each of the five weighting methods show relatively small differences, except for one (the distance-to-target method). The ranking of measures differs significantly, though, and as a result, so do the measures that are selected if total costs are restricted to a certain budget. Also, the consequent reduction in emissions of specific substances, in particular nitrogen oxides (NO_x), depends on the weighting method selected.

题目：通过最大减量化成本法计算具有多重环境影响行为的成本效益

作者：Tosihiro Oka, Masanobu Ishikawa, Yoshifumi Fujii, Gjalt Huppes

关键字：成本效益，生态效率，环境采购，外部性，绿色采购，产业生态学

摘要：产品往往具有多重环境影响。通过最大污染减排成本 (MAC)法可以评价引入一类环境污染较小产品的成本有效性，进而确定环境采购的优先级。相应环境措施的单位最大减排成本 (MAC) 与某种污染物的减排量相乘，即得该种污染物减量化所需的成本；进而加和某产品所有污染物的上述成本，得出总的可避免减排成本 (AAC)。比较 AAC 与购买产品所需的额外花费，若 AAC 更大，则产品的生态效率较高。文章通过一个工业泵的案例对 MAC 法进行了研究，并论述方法的优点与局限。

Calculating Cost-Effectiveness for Activities with Multiple Environmental Effects Using the Maximum Abatement Cost Method

Tosihiro Oka, Masanobu Ishikawa, Yoshifumi Fujii, and Gjalt Huppes

KEYWORDS:

cost-effectiveness, eco-efficiency, environmental procurement, externalities, green purchasing, industrial ecology

SUMMARY:
A maximum abatement cost (MAC) method is proposed as a means of assessing preferential purchasing of products with multiple environmental effects. Using the MAC method, cost-effectiveness of the introduction of a product with fewer emissions of some substances than conventional products can be assessed. In the MAC method, the reduction of a pollutant is multiplied by the MAC, the maximum unit cost of the measures taken elsewhere in society aiming to reduce the pollutant, and is added up over the relevant pollutants. The total sum, called avoidable abatement cost (AAC), is compared with the additional private cost of the product for the purchaser. When the additional private cost is smaller than the AAC, the product is regarded as relatively eco-efficient. The MAC method is illustrated with an assessment of industrial pumps. The advantages and limitations of the method are discussed.

题目：产品与过程的环境经济综合评价：生态效率分析法

作者：Ina Rüdenauer, Carl-Otto Gensch, Rainer Grießhammer, Dirk Bunke

关键字：集成，生命周期评价，生命周期成本核算，生命周期影响评价，产品所有总成本，加权

摘要：Öko 研究所开发的生态效率分析法可满足用户环境及经济方面分析的需求。与生命周期评价(LCA)相似，生态效率分析亦可衡量产品采购的优先顺序或确定产品开发过程的最优化程度。

生态效率分析基于两种方法：LCA 及生命周期成本核算。前者是关于产品及过程的环境评价(详见 ISO 14040 标准)，后者可给出一个或几个所有者所付出的全部成本。不同的环境影响指标可分开表示也可合而为一，只要不同方案的总体或分类的环境负担及总成本能够分别量化比较即可。

特定措施的环境及经济效果可通过一个二维坐标图加以表示，其中不同措施的效率量化为环境收益与经济成本之比。文章还更为详尽地讨论了生态效率法的结果、优点和局限之处，从而强化了决策分析过程。

Integrated Environmental and Economic Assessment of Products and Processes: A Method for Eco-Efficiency Analysis

Ina Rüdenauer, Carl-Otto Gensch, Rainer Grießhammer, and Dirk Bunke

KEYWORDS:

aggregation, life-cycle assessment, life-cycle costing, life-cycle impact assessment, total cost of ownership, weighting

SUMMARY:

The eco-efficiency analysis method developed and used by the Öko-Institut analyzes different alternatives that fulfill a defined consumer need, from an environmental as well as an economic perspective.

Like life-cycle assessment (LCA), eco-efficiency analysis makes possible the setting of priorities in purchasing decisions or can be used to show optimization potentials in product development processes.

Eco-efficiency analysis builds upon two methods: LCA, according to ISO 14040 (to assess the environmental aspects of products and processes), and life-cycle costing. Life-cycle costing results in a single figure—the total costs of ownership to one or several actors. The environmental impacts can be evaluated and aggregated as a single score or the impact category indicator results can be kept separate. In either case two single scores can be compared: the total environmental burden or the impact category indicator results, and the total costs of ownership of the alternatives under consideration.

The results can then be plotted in two-dimensional graphs that show the effectiveness of certain measures in environmental and economic terms. The efficiency is expressed as a numerical ratio of environmental savings to difference in costs.

Together with furnishing more detailed results and a discussion of additional benefits or potential barriers, eco-efficiency analysis broadens the basis for decision-making processes.

题目：如何衡量与监测地区的生态效率

作 者：Jyri Seppälä, Matti Melanen, Ilmo Mäenpää, Sirkka Koskela, Jyrki Tenhunen, Marja-Riitta Hiltunen

关键字：环境影响，区内生产总值，指标，生命周期评价 (LCA)，物流核算，产出，增加值

摘要：生态效率为可持续发展提供了商业方面的借鉴。本文侧重研究地区一级的生态效率，以及如何利用生态效率的概念增强芬兰 Kymenlaakso 地区的经济竞争力同时改善环境。研究旨在开发一套可监控区域生态效率变化的指标体系。这一工作从区域发展的环境与经济指标出发。环境方面采用了基于生命周期评价的环境影响指标，包括环境压力(如二氧化碳排放)、影响类型(如二氧化碳当量的气候变化影响)以及总体环境影响(各类环境影响的集成)。上述指标皆可根据 Kymenlaakso 地区的直接物流输入、总物流输入及总物流需求数据加以确定。经济方面则用到了区域生产总值、增加值及主要部门经济产出等指标。生态效率评价将经济与环境两方面的指标加以整合。某些情况下可直接将生态效率表示为经济指标与环境指标之商。在此可采用总产出(中间消费加增加值)作为经济指标，从而包括区域活动的上游过程。论文还讨论了不同环境影响指标的优点与不足。

How to Measure and Monitor the Eco-efficiency of a Region

Jyri Seppälä, Matti Melanen, Ilmo Mäenpää, Sirkka Koskela, Jyrki Tenhunen, and Marja-Riitta Hiltunen

KEYWORDS:

environmental impact, gross domestic product, indicator, life-cycle assessment (LCA), material flow accounts, output, value added

SUMMARY:

The concept of eco-efficiency is commonly referred to as a business link to sustainable development. In this article, eco-efficiency is examined at a regional level as an approach to promoting the competitiveness of economic activities in the Finnish Kymenlaakso region and mitigating their harmful impacts on the environment. The aim is to develop appropriate indicators for monitoring changes in the eco-efficiency of the region. A starting point is to produce indicators for the environmental and economic dimensions of regional development and use them for measuring regional eco-efficiency. The environmental impact indicators are based on a life-cycle assessment method, producing different types of environmental impact indicators: pressure indicators (e.g., emissions of CO_2), impact category indicators (e.g., CO_2 equivalents in the case of climate change), and a total impact indicator (aggregating different impact category indicator results into a single value). Environmental impact indicators based on direct material input, total material input, and total material requirement of the Kymenlaakso region are also assessed. The economic indicators used are the gross domestic product, the value added, and the output of the main economic sectors of Kymenlaakso. In the eco-efficiency assessment, the economic and environmental impact indicators are monitored in the same graph. In a few cases eco-efficiency ratios can also be calculated (the economic indicators are divided by the environmental indicators). Output (= value added + intermediate consumption) is used as an economic indicator related to the environmental impact indicators, which also cover the upstream processes of the region's activities. In the article, we also discuss the strengths and weaknesses of using the different environmental impact indicators.

题目：通过生态设计工具量化生态效率的方法实践

作者：Yoshinori Kobayashi, Hideki Kobayashi, Akinori Hongu, Kiyoshi Sanehira

关键字：X 倍跃进，综合评价，生命周期评价(LCA)，生命周期影响评价(LCIA)，生命周期规划(LCP)，质量功能配置(QFD)

摘要：产品级的生态效率定义为导致单位环境影响的产品产出价值。本文探讨了如何利用质量功能配置(QFD)和生命周期影响评价(LCIA)这两种制造业常用的方法确定生态效率。

QFD 是根据消费者偏好进行产品规划的方法，基于加权后的产品质量改进率，可计算产品的价值指标。其中消费者的要求通过 QFD 矩阵得到了特别体现。

产品全生命周期的环境影响则通过日本通行的 LCIA 方法加以确定。LCIA 给出了生命周期清单所列项目的多种最终环境影响，然后根据重视的程度加以综合，并给出单一的环境影响数值。

生态设计支持工具——包括生命周期规划(LCP)和生命周期评价(LCA)工具——已经得到了一定的开发和应用，并累积了许多有助于计算生态效率的数据：如产品价值可经由 LCP 工具中的 QFD 数值计算，而环境影响可通过 LCA 进行估计。

本文所述方法的有效性通过几个案例研究得到了验证，论文还对方法的优越之处作了说明。

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A Practical Method for Quantifying Eco-efficiency Using Eco-design Support Tools

Yoshinori Kobayashi, Hideki Kobayashi, Akinori Hongu, and Kiyoshi Sanehira

KEYWORDS:

FactorX, integrated assessment, life-cycle assessment (LCA), life-cycle impact assessment (LCIA), life-cycle planning (LCP), quality function deployment (QFD)

SUMMARY:

Eco-efficiency at the product level is defined as product value per unit of environmental impact. In this paper, we present a method for quantifying the eco-efficiency using quality function deployment (QFD) and life-cycle impact assessment (LCIA). These well-known tools are widely used in the manufacturing industry.

The QFD, which is one of the methods for product planning based on consumer preferences, is introduced to calculate the product value. An index of the product value is calculated as the weighted average of improvement rates of quality characteristics. The importance of the customer requirements, derived from the QFD matrix, is applied.

Environmental impacts throughout a product life cycle are calculated based on an LCIA method widely used in Japan. By applying the LCIA method of endpoint type, the endpoint damage caused by various life-cycle inventories is calculated. Willingness to play is applied to integrate it into a single index.

Eco-design support tools, namely, the life-cycle planning (LCP) tool and the life-cycle assessment (LCA) tool, have already been developed. Using these tools, data required for calculation of the eco-efficiency of products can be collected. The product value is calculated based on QFD data stored in the LCP tool and the environmental impact is calculated using the LCA tool.

Case studies of eco-efficiency are adopted and the adequacy of this method is clarified. Several advantages of this method are characterized.

题目：环境政策中污染排放的货币估值：基于政策目标的污染减排成本法

作者：Marc D. Davidson, Bart H. Boon, Jessica van Swigchem

关键字：影子价格，效率，成本效益，污染减排成本，产业，成本效益分析

摘要：多种环境决策都需确定污染排放的货币价值。污染减排成本法通过确定实现污染减排政策目标时的污染物减排边际成本，给出污染排放的货币价值。该方法提供了污染排放的影子价格，据其可衡量某一技术措施是否是所能采取的满足当前环境政策目标的最成本有效措施。本文认为，当关于某种污染物的政策目标（如全国污染减排目标）十分明确时，通过污染减排成本法确定的影子价格较其它方法所得到的影子价格在实践中的更有优势。污染减排成本法有助于保证环境政策不走样地、成本有效地加以实施。

Monetary Valuation of Emissions in Implementing Environmental Policy: The Reduction Cost Approach Based upon Policy Targets

Marc D. Davidson, Bart H. Boon, and Jessica van Swigchem

KEYWORDS:

shadow prices, efficiency, cost effectiveness, reduction costs, industry, cost-benefit analysis

SUMMARY:
At various levels of environmental policy making there is a demand to translate polluting emissions into monetary units. In the so-called reduction cost approach, based upon policy targets, polluting emissions are expressed in monetary terms by determination of the marginal unit reduction cost at the emission target level. This approach provides shadow prices for emissions by which it can be established whether a certain measure or technology belongs to the most efficient set of measures by which the policy targets can be reached. This article argues that, if clear (generic) government targets such as national emission reduction targets exist for an emission, shadow prices derived by this method are to be preferred to shadow prices derived by other methods for decisions at the project (implementation) level. By application of the reduction cost approach, implementation decisions can be made that are both cost-effective and consistent with government policy.

题目：实用生态效率：比较企业在不同业务领域的环境投资

作者：Roland W. Scholz, Arnim Wiek

关键字：企业投资策略，环境业务，环境决策支持工具，环境评价，产业生态学，交通影响补偿

摘要：生态效率已经成为企业环境管理的一个核心概念。很多方法侧重于企业及产品级的环境效率。但是，当企业拥有可用于环境业务或投资的特殊预算时，将资金置于何处生态效率最大是一个有待研究的问题。本文提供了一个计算具体操作的环境效率进而作出相应决策支持的方法。该方法被用于研究瑞士国家铁路公司的案例，并评价了不同的投资领域，包括能源、景观及自然保护、噪音防治及受污染土壤恢复。通过比较不同领域及相同领域中不同操作的优劣缓急，决策者可以制订更为合理的环境投资策略。

Operational Eco-Efficiency: Comparing Firms' Environmental Investments in Different Domains of Operation

Roland W. Scholz and Arnim Wiek

KEYWORDS:

corporate investment policy, environmental operations, environmental decision support tool, environmental assessment, industrial ecology, traffic impact compensation

SUMMARY:
Eco-efficiency has been established as a crucial concept for corporate environmental management. Most approaches deal with eco-efficiency on the level of the company or the product. However, given that companies have special budgets earmarked for environmental operations or investments, the question arises as to which operation within which domain is the most eco-efficient. This article presents an approach to supporting these decisions by calculating eco-efficiency on the operational level. The procedure is demonstrated using a case study of the Swiss National Railway Company. Investments and operations in the domains of energy, landscape and nature conservation, noise protection, and contaminated soil remediation are assessed and compared. Decision-makers seeking an eco-efficient corporate investment policy will find, in this concept, a guideline for prioritizing various domains of operation as well as the operations within a domain.

题目：英国钢铁工业与制铝工业的生态效率发展趋势及资源效率与资源生产力的差异

作者：Kristina Dahlström, Paul Ekins

关键字：铝，效率，产业生态学，生产力，钢，增加值

摘要：生态效率指标涵盖了经济和环境两方面的变量，它有助于引导人类使用最小的投入获得最大的产出。但关于生态效率的(特别是涉及公共利益的)环境影响方面的变量尚存争议。本文研究了过去 30 年间英国钢铁工业和炼铝工业的资源与产出情况，发现即使在产业生态效率的经济指标选择方面也存在着严重的问题。

英国钢铁及炼铝工业的自然资源利用率已经有了很大的改进，但同时单位原料和能源消耗的产值(增加值)不增反降。这一似乎矛盾的结果可能源于金属实际价格的下降。此外随着竞争的加剧，金属工业不得不大力削减生产成本，这进一步间接导致了相关工业产值的减少。

本文认为生态效率指标的理论完备性和一致性尚有待改进，为此建议区分基于单位实物投入的经济产出和单位实物投入的实物产出两类指标，它们反映了生态效率的不同方面，都有着重要的实用价值。

Eco-Efficiency Trends in the U.K. Steel and Aluminum Industries: Differences between Resource Efficiency and Resource Productivity

Kristina Dahlström and Paul Ekins

KEYWORDS:

aluminium, efficiency, industrial ecology, productivity, steel, value added

SUMMARY:

Measures of eco-efficiency—broadly understood as "getting more from less"—often include an economic and an environmental variable. The latter is often seen as the more problematic variable, particularly when in relation to impacts of public concern. But an analysis of resource and value trends in the U.K. steel and aluminum industries over the last 30 yr showed that there are significant problems associated with using economic variables in measures of eco-efficiency at the sectoral level.

The research found that the U.K. steel and aluminum industries have improved the effectiveness with which they use natural resources, but that this has been accompanied by a decline in the economic output (value added) per unit of material or energy consumed. These seemingly contradictory results can be explained by the fall in the price of metals in real terms, and by the competitive pressures that necessitate the cutting of production costs and indirectly lead to a fall in the measure of economic output of the relevant industry.

The research also suggests a logical terminology to bring consistency and coherence to the broad field of eco-efficiency indicators, with an important distinction made between measures that examine the value output per unit of physical input, and measures that examine the physical output per unit of physical input. Both these types of indicators are important, as they highlight different aspects of eco-efficiency.

题目：通过环境成本效率指标评价末端治理技术的生态效率：一个固体废物管理的案例

作者：Stefanie Hellweg, Gabor Doka, Göran Finnveden, Konrad Hungerbühler

关键字：焚烧，指标，产业生态学，填埋，机械生物处理 (MBP)，废物处理

摘要：生态效率通常定义为经济增加值与环境影响之比，正越来越多地用于综合评价产品系统、过程及企业的环境与经济表现。但对于末端处理技术而言，这一定义并不适用，因为末端处理是通过付出一定经济成本来获得环境方面的改善。就此问题，本文提出了一个评价末端技术的指标——环境成本效率 (ECE) 指标，定义为净环境效益与净成本之比。ECE 用于评价四类城市垃圾的末端处理方法，包括卫生填埋、机械生物处理、新式焚烧炉焚烧及分段热处理 (热解和气化)。各类方法的净环境效益通过生命周期评价加以确定，净成本 (成本减去效益) 亦可近似确定。结果表明相对于焚烧处理，卫生填埋与机械生物处理的成本低但环境危害大。作者还进一步计算了各种技术组合的 ECE。长期看来，分段热处理是环境成本效率最佳的固体废物处理方法，次之为机械生物处理和新式焚烧炉。

Journal of Industrial Ecology

Assessing the Eco-Efficiency of End-of-Pipe Technologies with the Environmental Cost Efficiency Indicator: A Case Study of Solid Waste Management

Stefanie Hellweg, Gabor Doka, Göran Finnveden, and Konrad Hungerbühler

KEYWORDS:

incineration, indicator, industrial ecology, landfill, mechanical-biological treatment (MBP), waste treatment

SUMMARY:
The concept of eco-efficiency is increasingly being applied to judge the combined environmental and economical performance of product systems, processes, and/or companies. Eco-efficiency is often defined by the ratio of economic value added to environmental impact added. This definition is not appropriate for end-of-pipe treatment technologies because these technologies aim at improving the environmental performance of technical processes at the cost of financial expense. Therefore, an indicator for the assessment of end-of-pipe technologies has been proposed. This indicator, called environmental cost efficiency (ECE), is defined as the ratio of net environmental benefits to the difference in costs. ECE is applied to four end-of-pipe technologies for the treatment of municipal solid waste: sanitary landfill, mechanical-biological treatment, modern grate incineration, and a staged thermal process (pyrolysis and gasification). A life-cycle assessment was performed on these processes to quantify the net environmental benefit. Moreover, the approximate net costs (costs minus benefits) were quantified. The results show that, relative to grate incineration, sanitary landfills and mechanical-biological treatment are less costly but environmentally more harmful. We calculated the ECE for all combinations of technologies. The results indicate that the staged thermal process may be the most environmentally cost-efficient alternative to all other treatment technologies in the long run, followed by mechanical-biological treatment and grate incineration.

题目：兵库县生态城汽车及家电高级闭路循环系统的生态效率分析

作者：Tohru Morioka, Kiyotaka Tsunemi, Yugo Yamamoto, Helmut Yabar, Noboru Yoshida

关键字：报废产品，产业生态学，工业联合体，零件重复使用，钢铁工业，废轮胎气化

摘要：产业生态学的重大挑战之一在于实现物料的闭路循环。这有赖于在最初的生产阶段最大限度的使用可回收利用的材料、零件和产品，并尽可能保持其初始的性能。本文设计了服务于兵库县生态城的报废汽车和家电的高级闭路循环系统，开发了用于评价这类系统的生态效率的方法，并基于物流分析及生命周期评价数据测算了所设计闭路循环系统的生态效率。

通过工业联合体和高级闭路循环系统实现报废汽车的循环利用，经济产值比传统的回收系统提高了 114%，以直接物料投入计的生态效率亦提高了 57%。新系统在生产过程中综合利用了来自各产业部门的副产物及废物。在废旧家电方面，高级闭路循环系统同样有效地改进了生态效率，与常规的旧产品淘汰以及单纯回收材料不同，新系统通过零件的重复使用延长了产品的寿命，并将二氧化碳排放降低了 4%。

Journal of Industrial Ecology

Eco-efficiency of Advanced Loop-Closing Systems for Vehicles and Household Appliances in Hyogo Eco-Town

Tohru Morioka, Kiyotaka Tsunemi, Yugo Yamamoto, Helmut Yabar, and Noboru Yoshida

KEYWORDS:

end-of-life products, industrial ecology, industrial complex, parts reuse, steel industry, waste tires gasification

SUMMARY:

The closing of material loops is a critical challenge in industrial ecology. It relies mainly on the utilization of recovered materials/parts/products in the original and principal production system while their original function is retained at the highest level possible. In this study, advanced loop-closing systems for the recycling of end-of-life vehicles and electric household appliances are first designed in "Hyogo Eco-town." Second, a methodology for evaluating the eco-efficiency of these systems is developed. Finally, the eco-efficiency of the designed advanced loop-closing strategies for the two products is evaluated, based on the results of materials flow analysis and life-cycle assessment.

The results show that, compared with conventional recycling systems, when an industrial complex and an advanced loop-closing system for end-of-life vehicles are established, the total economic value increases by 114% and the eco-efficiency in terms of the amount of direct material input is improved by 57%. This system permits the utilization of the by-products, wastes, and recovered materials that originate from other industrial sectors as input to production activities. In the case of end-of-life electric household appliances, an advanced loop-closing strategy to lengthen the product life with parts reuse improves the eco-efficiency in terms of carbon dioxide (CO_2) emissions by 4% compared with the conventional replacement of the appliance with a new product along with the material recycling option.

题目：中小企业污染预防的生态效率：韩国案例研究

作者：Sangwon Suh, Kun Mo Lee, Sangsun Ha

关键字：电镀，生命周期评价(LCA)，多属性决策，标准化，总成本核算(TCA)，加权

摘要：本文开发了一种评价产品生态效率的方法并将其用于中小企业的污染预防项目。总成本核算及生命周期评价可分别给出成本及环境方面的指标。加以标准化之后，综合上述指标，即可得到一个产品系统的生态效率简图。该方法用于研究生产电子设备(如移动通讯基站)的韩国中小企业案例。研究发现镀银过程是决定产品总成本及环境影响的关键。为此提出了一系列改进方案，包括使用产品绝缘层、筛状辅助电极、均衡电镀技术、废物流分离和无氰电镀等；并验证了在现有产品规格及企业财务能力和占地情况下采用上述替代技术的可行性。这些改进方案的效果同样加以图示，该图有助于决策者比较经济与环境方面的得失。

Eco-Efficiency for Pollution Prevention in Small to Medium-Sized Enterprises: A Case from South Korea

Sangwon Suh, Kun Mo Lee, and Sangsun Ha

KEYWORDS:

electroplating, life-cycle assessment (LCA), multiattribute decision making, normalization, total cost assessment (TCA), weighting

SUMMARY:
A simple method of representing the eco-efficiency (E/E) of a product system has been developed and applied to a pollution prevention program at a small to medium-sized enterprise (SME). Cost-side and environment-side indicators were derived using total cost accounting and life-cycle assessment, respectively. The derived indicators were subsequently normalized to reference values representing the current cost and environmental situation. By combining these normalized indicators, the E/E of a product system can be expressed on a simple graph. The method was applied in a case study carried out at a South Korean SME producing components for electronic equipment such as mobile communication base stations. A silver-plating process was identified as one of the key processes driving a substantial fraction of the total cost and aggregate environmental impact of the product system. Focusing on the key issues identified, a series of alternative processes, including use of a product insulation cover, a sieve-type ancillary electrode, a balanced-uniform plating technique, stream segregation, and noncyanide electroplating, were proposed. The feasibility of these alternatives was validated against product specifications as well as the company's financial and spatial capacity. The potential improvements accruing from these alternatives are presented as a simple graph that can be used by decision makers to readily identify trade-offs between economic and environmental issues.