JOURNAL OF INDUSTRIAL ECOLOGY

中文摘要
《产业生态学报》
第4卷第4期

翻译
施涵

Chinese Abstracts
Journal of Industrial Ecology
Volume 4, Number 4

Translated by
Shi Han

《产业生态学报》

2000 年冬，第 4 卷第 4 期，13-30 页

题目：IPAT 等式及其变化：对技术和环境影响不断变化的看法

作者：Marian R. Chertow

关键字：环境技术、X 倍改进、IPAT 公式、主公式、技术演变、技术乐观主义者

摘要：20 世纪 70 年代初期，Ehrlich 和 Holdren 在与 Commoner 的讨论中发明了一个公式，来描述三个导致环境影响的主要因素，即环境影响（I）是人口（P）、富裕程度(A)和技术(T)之乘积。本文回顾了 IPAT 公式在过去 30 多年中的演变过程，用来认识很多环保主义者是如何逐渐接受技术对于可持续发展具有积极作用的观念。虽然 IPAT 公式一度曾被用来确定上诉三个因素中哪一个对环境的破坏作用最大，但是产业生态学改变了该等式的这种用法，认为在多数情况下，人口和财富增长的负面影响，可以由改进技术系统所带来的环境改善所抵消。

Journal of Industrial Ecology

2000, Vol. 4, Issue 4, pp. 13-30

The IPAT Equation and Its Variants: Changing Views of Technology and Environmental Impact

Marian R. Chertow

KEYWORDS:

environmental technology, Factor X, IPAT equation, master equation, technological change, technological optimism

SUMMARY:

In the early 1970s Ehrlich and Holdren devised a simple equation in dialogue with Commoner identifying three factors that created environmental impact. Thus, impact (I) was expressed as the product of (1) population, (P); (2) affluence, (A); and (3) technology, (T). This article tracks the various forms the IPAT equation has taken over 30 years as a means of examining an underlying shift among many environmentalists toward a more accepting view of the role technology can play in sustainable development. Although the IPAT equation was once used to determine which single variable was the most damaging to the environment, an industrial ecology view reverses this usage, recognizing that increases in population and affluence can, in many cases, be balanced by improvements to the environment offered by technological systems.

《产业生态学报》

2000 年冬，第 4 卷第 4 期，31-46 页

题目：生命周期思想在市场主体的日常活动中的制度化

作者：Eva Heiskanen

关键词：环境决策、框架、制度化、生命周期评价(LCA)、生命周期管理、公众理解

摘要：从经济主体开展基本决策的角度来看， LCA 的流行是很难理解的。在本杂志 1997 年的一篇文章中，Enrenheld 指出 LCA 改变世界的潜在作用比运作决策工具更加重要。本研究旨在探讨如何将“LCA 世界观”在一般的市场主体中加以制度化。这在当前环境政策日益依赖于市场行为的背景下变得十分重要。本项研究通过实际数据以及从由芬兰普通生产商、销售商和消费者代表参加的关于产品与环境的专门座谈会获得的数据来检验有关 LCA 权威文档的各种规范化的假设。这些假释包括：⑴“从摇篮到坟墓”的方法；⑵所有产品都有环境影响并可以得到改进的观点；⑶环境价值的相对性；⑷导致环境负担的责任追究方式。这些假设之间的紧密联系和差别都被列举出来。文章指出，生命周期思想不仅可以做为一种重要工具来使用，而且具有一定的深层次价值。本文旨在建立一个能够帮助理解 LCA 之所以流行的更广泛的制度背景。同样，本文还从这个大的背景出发，指出 LCA 以及生命周期思想在未来发展中可能遭遇的挑战。

Journal of Industrial Ecology

2000, Vol. 4, Issue 4, pp. 31-46

Institutionalization of Life-Cycle Thinking in the Everyday Discourse of Market Actors

Eva Heiskanen

KEYWORDS:
environmental decision making, framing, institutionalization, life-cycle assessment (LCA), life-cycle management, public understanding

SUMMARY:
The widespread popularity of life-cycle assessment (LCA) is difficult to understand from the point of view of instrumental decision making by economic agents. Ehrenfeld has argued, in a 1997 issue of this journal, that it is the world-shaping potential of LCA that is more important than its use as a decision-making tool. The present study attempts to explore the institutionalization of this "LCA world view" among ordinary market actors. This is important because environmental policy relies increasingly on market-based initiatives. Cognitive and normative assumptions in authoritative LCA documents are examined as empirical data and compared with data from focus group interviews concerning products and the environment with "ordinary" manufacturers, retailers, and consumers in Finland. These assumptions are (1) the "cradle-to-grave" approach, (2) the view that all products have an environmental impact and can be improved, (3) the relativity of environmental merit, and (4) the way responsibility for environmental burdens is attributed. Relevant affinities, but also differences, are identified. It is argued that life-cycle thinking is not primarily instrumental, but rather is gaining a degree of intrinsic value. The study attempts to establish a broader institutional context in which the popularity of LCA can be understood. From the point of view of this broader context, some future challenges for the development of LCA and life-cycle thinking are suggested.

《产业生态学报》

2000 年冬，第 4 卷第 4 期，47-60 页

题目：加权方法的实际做法对生命周期评价应用于决策过程的影响

作者：Magnus Bengtsson

关键词：决策、环境影响权衡比较、解释、生命周期评价(LCA)、系统分析、加权方法

摘要：本文研究了北欧地区一些公司在 LCA 研究中如何权衡比较不同的环境影响。通过面访，我们研究了在决策过程中如何使用和认识加权方法。分析表明，决策人员需要一个能够帮助他们综合和解释生命周期清单分析得到的复杂信息的方法。他们赞同这类方法并不需要反映他们自身的价值观，但他们对应该使用何种价值判断基础存在不同的看法。本研究还分析了使用加权方法所面临的困难。决策人员似乎给加权方法赋予了更广泛的内涵，而且相对比较不同类别的环境影响，他们更加关注对比环境影响与其他类别的影响。我们的结论是决策者需要更多地参与到建模和解释过程中来。分析人员的作用应该分析决策人员的信息需求，并帮助他们选择符合自身需求和观点的方法。为实现这个目标，重要的是决策者不应把 LCA 当作是一个高度标准的计算方法，而是将其视为一个收集、组织和解释环境信息的灵活过程。这样应用 LCA 的做法将会增强 LCA 结果的相关性和有效性

Journal of Industrial Ecology

2000, Vol. 4, Issue 4, pp. 47-60

Weighting in Practice: Implications for the Use of Life-Cycle Assessment in Decision Making

Magnus Bengtsson

KEYWORDS:

decision making, environmental trade-offs, interpretation, life-cycle assessment, LCA, systems analysis, weighting methods

SUMMARY:

This article investigates how environmental trade-offs are handled in life-cycle assessment (LCA) studies in some Nordic companies. Through interviews, the use and understanding of weighting methods in decision making was studied. The analysis shows that the decision makers require methods with which to aggregate and help interpret the complex information from life-cycle inventories. They agreed that it was not their own values that should be reflected in such methods, but they were found to have different opinions concerning the value basis that should be used. The analysis also investigates the difficulties arising from using such methods. The decision makers seemed to give a broader meaning to the term weighting, and were more concerned with the comparison between environ-mental and other aspects than the weighting of different environmental impacts. A conclusion is that decision makers need to be more involved in modeling and interpretation. The role of the analyst should be to interpret the information needs of the decision maker, and help him or her make methodological choices that are consistent with these needs and relevant from his or her point of view. To achieve this, it is important that decision makers do not view LCA as a highly standardized calculation tool, but as a flexible process of collecting, organizing, and interpreting environmental information. Such an approach to LCA increases the chances that the results will be regarded as relevant and useful.

《产业生态学报》
2000 年冬，第 4 卷第 4 期，61-82 页

题目：使用学习系统对产品设计概念进行简化生命周期评价

作者：Inês Sousa, Julie L. Eisenhard 和 David R. Wallace

关键词：人工神经网络，一体化产品设计，学习系统，生命周期评价(LCA)，产品描述，简化生命周期评价(SLCA)

摘要：LCA 参数模型已经与传统设计工具结合，并被证明用来对详细的设计变量开展快速、全面的分析约束因素。然而，若要把分析性环境评估纳入产品设计早期阶段，我们必须采用一个新的方法。通常，在产品设计早期存在着许多不同的互相竞争的产品设计概念。在缺乏信息的情况下，我们还必须快速地做出决策。本文旨在探索开展简化 LCA 的一个近似方法。在这个方法中，我们可以在产品概念设计阶段，通过学习现有产品的特征，在无需建立新产品模型的前提下快速得到新产品在环境方面的基本设计概念。人工神经网络可以从现有产品中归纳总结出产品特性和环境数据目录。然后，产品设计小组可以将更进一步的产品设计特性输入到人工神经网络中，并快速得到新产品设计概念的环境影响评价。当学习系统的基础建立后，分散的、基于目标的环境模型就可以投入应用。实践表明，它可以用来预测生命周期能耗，并可以预测固体废物、臭氧层减少、酸雨、湖泊富营养化和冬季夏季烟雾等。

Journal of Industrial Ecology
2000, Vol. 4, Issue 4, pp. 61-82

Approximate Life-Cycle Assessment of Product Concepts Using Learning Systems

Inês Sousa, Julie L. Eisenhard and David R. Wallace

KEYWORDS:
artificial neural networks, integrated product, design, learning systems, life-cycle assessment, LCA, product descriptors, streamlined LCA

SUMMARY:
Parametric life-cycle assessment (LCA) models have been integrated with traditional design tools and used to demonstrate the rapid elucidation of holistic, analytical trade-offs among detailed design variations. A different approach is needed, however, if analytical environmental assessment is to be incorporated in very early design stages. During early stages, there may be competing product concepts with dramatic differences. Detailed information is scarce, and decisions must be made quickly. This article explores an approximate method for providing preliminary LCAs. In this method, learning algorithms trained using the known characteristics of existing products might allow environmental aspects of new product concepts to be approximated quickly during conceptual design without defining new models. Artificial neural networks are trained to generalize on product attributes, which are characteristics of product concepts, and environmental inventory data from preexisting LCAs. The product design team then queries the trained artificial model with new high-level attributes to quickly obtain an impact assessment for a new product concept. Foundations for the learning system approach are established, and then an application within the distributed object-based modeling environment (DOME) is provided. Tests have shown that it is possible to predict life-cycle energy consumption, and that the method could be used to predict solid waste, greenhouse effect, ozone depletion, acidification, eutrophication, winter and summer smog.

Errata
In the last paragraph of the Surrogate Model Tests section on page 74, the sentence that reads "Life-cycle energy predictions were between 0.4% and 41% of the levels given by the true LCA analyses." has an error.

The CORRECT sentence (with the change noted in blue) is: "Life-cycle energy predictions were between 0.4% and 41% off of the levels given by the true LCA analyses."

《产业生态学报》
2000 年冬，第 4 卷第 4 期，83-103 页

题目：计算机行业中的环境供应链管理：一个交易成本的经济学看法

作者：Christine Meisner Rosen, Janet Bercovitz 和 Sarah Beckman

关键词：契约，面向环境的设计（DFE），环境管理系统（EMS），绿色供应链，设备生产厂商（OEM），半导体生产商

摘要：本文将交易成本经济学理论作为基础，用它来研究计算机行业的合同机制。计算机业利用这种机制设立项目以鼓励其供应商改进自身环境管理系统和产品的环境表现。我们研究了计算机行业要求供应商投资于改进产品的环境表现和环境管理实践的特殊技术所关联的经济交易风险，以及计算机行业用以保护自身避免这些风险的关系合同机制。我们还介绍了我们采访的经理们对于各种交易风险的重要性以及他们认为自己公司将如何应对这类风险。在文章最后，我们试图总结未来需要进一步研究的问题。使用交易成本经济学（TCE）可以帮助我们分析计算机行业是如何构建其和供应商之间在环境领域的关系，我们希望表明社会科学理论是如何可以用来丰富和增加工程技术人员和产业生态学主流领域的人员工作的实用性。

Journal of Industrial Ecology

2000, Vol. 4, Issue 4, pp. 83-103

Environmental Supply-Chain Management in the Computer Industry: A Transaction Cost Economics Perspective

Christine Meisner Rosen, Janet Bercovitz and Sarah Beckman

KEYWORDS:
contracting, design for environment (DfE), environmental management systems (EMS), greening the supply chain, original equipment manufacturers (OEM), semiconductors manufacturers

SUMMARY:
Our article uses the theory of transaction cost economics as a conceptual basis for examining the contracting mechanisms by which firms in the computer industry structure programs to encourage their suppliers to improve their environmental management systems and/or the environmental quality of their products. We explore the economic transactions hazards associated with asking suppliers to invest in the specialized technologies required to improve environmental performance of products and management practices and the relational contracting mechanisms computer industry firms are using to protect themselves against these hazards. We also describe the importance the managers we interviewed attributed to various transactions hazards and their perceptions of how well their firms were coping with them. We conclude by discussing questions for future research. By using TCE to frame our analysis of how computer manufacturers are structuring their relationships with their suppliers in the environmental area, we hope to show how social science theory can be used to enrich and increase the practicality of the work done by engineers and others in the mainstream areas of the industrial ecology field.

《产业生态学报》
2000 年冬，第 4 卷第 4 期，105-126 页

题目：芬兰物流的分解分析：1960-1996

作者：Jukka Hoffrén, Jyrki Luukkanen 和 Jari Kaivo-oja

关键词：分解分析，非物质化，因素索引，减物质化，材料流分析（MFA），反弹效应

摘要：由于环境影响在相当程度上与经济生产过程中投入的物质总量成正比，所以这种影响可以通过减少资源用量来缓解——也就是说集中在曾经所说的质量增长上。本文简要介绍了芬兰在 1960－1996 年期间的资源使用状况，用来评估资源使用的总体趋势，并用作为评估可持续性的基础。本文采用了能源研究中发展而来的分解分析法，并用该方法来分解各行业的经济活动（活动效应），工业活动结构（结构效应）和物质使用强度（强度效应）改变而产生的影响。根据本文所做分析，在 1960-1996 年间，芬兰在电力、天然气和供水、纸浆和造纸、土建，以及采矿等行业的物质消耗急剧增长。同期，单位资源消耗所产生的 GDP 也增加了 175%。经济增长导致基础设施建设领域的资源消耗增长最大；例如公路，水路，供电、供气和供水设施，和造纸和纸制品生产等。资源消耗增长最小的领域是运输、基础金属生产和采矿业。

Journal of Industrial Ecology

2000, Vol. 4, Issue 4, pp. 105-126

Decomposition Analysis of Finnish Material Flows: 1960-1996

Jukka Hoffrén, Jyrki Luukkanen and Jari Kaivo-oja

KEYWORDS:
decomposition analysis, dematerialization, factor index, immaterialization, materials flow analysis (MFA), rebound effect

SUMMARY:
To the extent that environmental impacts are the consequence of the magnitude of total material input into production in an economy, they can be lessened by reducing the use of materials- by concentrating on what has been called qualitative growth. This article presents a summary of Finnish resource use over the period 1960-1996 as a means of evaluating the trends in material use and providing a basis for assessments of sustainability. It adapts the technique of decomposition analysis developed in the field of energy studies to distinguish the effects of changes in aggregate economic activity ("activity effect"), composition of industrial activity ("structural effect") and materials in-tensity of use ("intensity effect") on a sectoral basis. According to the analysis presented here, materials consumption in Finland has grown substantially between 1960 and 1996 in the electricity, gas and water supply, pulp and paper production, civil engineering, and mining and quarrying sectors. In the same period, the ratio of GDP/mass of material mobilized has improved by 175 percent. Economic growth has caused the largest increases in materi-als use in the building of infrastructures; for example roads, waterways, means of supplying electricity, gas, and water, and in the production of paper and paper products. The least growth took place in the transport, basic metals production, and mining and quarrying sectors.

《产业生态学报》
2000 年冬，第 4 卷第 4 期，127-148 页

题目：传统的、基于投入产出表的生命周期清单分析的错误

作者：Manfred Lenzen

关键词：投入产出分析，生命周期请单，过程分析，系统边界选择，选择错误，不确定性

摘要：传统的用来编制生命周期请单的过程分析技术存在一个选择错误，这种错误是由于忽视了生产过程的上游环节的资源消耗或污染排放造成的。虽然这种选择错误的大小会因相应产品和生产过程的不同而不同，但是有可能达到了 50%以上。一种避免类似严重错误的方法是在 LCA 过程中增加投入产出分析，由此得到了一个混合生命周期请单方法。使用 Monte一Carlo 模拟，可以计算基于投入一产出分析的 LCA 不确定性，常常低于 3 个层次的过程分析可能的选择错误。

Journal of Industrial Ecology

2000, Vol. 4, Issue 4, pp. 127-148

Errors in Conventional and Input-Output-based Life-Cycle Inventories

Manfred Lenzen

KEYWORDS:

input-output analysis, life-cycle inventory, process analysis, system boundary selection, truncation error, uncertainty

SUMMARY:

Conventional process-analysis-type techniques for compiling life-cycle inventories suffer from a truncation error, which is caused by the omission of resource requirements or pollutant releases of higher-order upstream stages of the production process. The magnitude of this truncation error varies with the type of product or process considered, but can be on the order of 50%. One way to avoid such significant errors is to incorporate input-output analysis into the assessment framework, resulting in a hybrid life-cycle inventory method. Using Monte-Carlo simulations, it can be shown that uncertainties of input-output-based life-cycle assessments are often lower than truncation errors in even extensive, third-order process analyses.