



JOURNAL OF
INDUSTRIAL ECOLOGY



中文摘要
《产业生态学报》
第23卷第3期

Chinese Abstracts
Journal of Industrial Ecology
Volume 23, Issue 3

翻译

Translated by

张安迎 黄蓓佳 黄莹 余颢凡 任亚楠
丛薇 雷锦明 李智伟 李霄

Anying Zhang,
Beijia Huang, Ying Huang, Haofan Yu, Yanan Ren,
Wei Cong, Jinming Lei, Zhiwei Li, Xiao Li

《产业生态学报》

2019 年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12779>

交互式可视化与产业生态学

应用、挑战与机遇

作者: David Font Vivanco, Paul Hoekman, Tomer Fishman, Stefan Pauliuk, Sidney Niccolson, Chris Davis, Tamar Makov, Edgar Hertwich

关键字: 数据分析, 教育培训, 产业生态学, 交互式可视化, 科学传播, 透明度

摘要:

产业生态学 (IE) 中日益复杂数据的涌现引起了学术界对交互式可视化 (IV) 的兴趣。IV 允许用户与数据交互, 帮助处理和解释复杂的数据集、过程及模拟。因此, IV 可以帮助 IE 从业者交流其方法和结果的复杂性, 阐明潜在的研究假设, 实现更透明的数据质量和数据错误监控。这可以显著地增加研究的覆盖范围和影响, 促进研究的透明度、可重复性和开放性, 并提高 IE 研究的清晰度和表现力。对 IV 当前应用的综述研究表明, 虽然数据探索在 IE 从业者中受到了一些关注, 但 IV 在科学传播中的应用是显著缺乏的。本研究基于一个工作实例探索了 IV 的价值, 讨论了其操作, 并强调了 IE 社区在应用 IV 时必须面临的挑战。这些挑战包括技术和知识限制、用户交互限制及实施策略限制。考虑到这些挑战, 本研究概述了未来几年将 IE 领域提升到科学传播最前沿的关键方面。其中, 我们起草了“产业生态学交互式可视化中心”的基本原则, IE 从业者可以在该中心找到一系列面向 IE 数据集的可视化工具。IV 将持续存在, 当前处于扩张阶段, 这为 IE 从业者提供了许多机会来塑造其操作性, 并从其早期应用中受益。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12779>

Interactive Visualization and Industrial Ecology: Applications, Challenges, and Opportunities

David Font Vivanco, Paul Hoekman, Tomer Fishman, Stefan Pauliuk, Sidney Niccolson, Chris Davis, Tamar Makov, Edgar Hertwich

Keywords: Data analysis, education and training, industrial ecology, interactive visualization, scientific communication, transparency

Summary:

The emergence of increasingly complex data in industrial ecology (IE) has caused scholarly interest in interactive visualization (IV). IV allows users to interact with data, aiding in processing and interpreting complex datasets, processes, and simulations. Consequently, IV can help IE practitioners communicate the complexities of their methods and results, shed light on the underlying research assumptions, and enable more transparent monitoring of data quality and error. This can significantly increase the reach and impact of research, promote transparency, reproducibility, and open science, as well as improve the clarity and presentation of IE research. A review of current IV applications reveals that, while data exploration has received some attention among IE practitioners, IV applications in scientific communication are clearly lacking. With the help of a working example, we explore the value of IV, discuss its operationalization, and highlight challenges that the IE community must face during IV uptake. Such challenges include technical and knowledge limitations, limits on user interaction, and implementation strategies. With these challenges in mind, we outline key aspects needed to lift the IE field to the forefront of scientific communication in the coming years. Among these, we draft the basic principles of a “Hub for Interactive Visualization in Industrial Ecology” (HIVE), a point of encounter where IE practitioners could find an array of data visualization tools that are geared toward IE datasets. IV is here to stay, and its inceptive stage presents many opportunities to IE practitioners to shape its operationalization and benefit from early adoption.

《产业生态学报》

2019年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12769>

节约食品的包装策略 2030年研究议程

作者: Fredrik Wikstrom, Karli Verghese, Rafael Auras, Annika Olsson, Helén Williams, Renee Wever, Kaisa Gronman, Marit Kvalvag Pettersen, Hanne Møller and Risto Soukka

关键字: 食物损失, 食物浪费, 产业生态学, 包装, 包装策略, 可持续性

摘要:

充分的考虑和优化包装可以避免食物损失和浪费。我们在此建议一些必须探讨的问题, 并总结这些问题所面临的挑战。根据作者的丰富经验, 以及多个利益相关者的参与讨论, 我们归纳出了五个主要的问题。问题分类如下: (1) 识别并获取影响食物浪费的包装行为的具体数据; (2) 通过考虑产品保护、保存和环境足迹之间的权衡, 来了解产品/包装的总环境负担; (3) 了解如何评价这些包装行为的环境足迹; (4) 兼顾减少食物浪费的包装设计改进; (5) 分析利益相关者的激励措施, 以减少食物损失和浪费。有利于食品节约的包装措施对于实现联合国可持续发展目标——在零售和消费者层面减少人均全球食物浪费, 减少生产和供应链中的食物损失非常重要。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12769>

Packaging Strategies that Save Food : A Research Agenda for 2030

Fredrik Wikstrom, Karli Verghese, Rafael Auras, Annika Olsson, Helén Williams, Renee Wever, Kaisa Gronman, Marit Kvalvag Pettersen, Hanne Møller and Risto Soukka

Keywords: food loss, food waste, industrial ecology, package, packaging strategies, sustainability

Summary:

Thoroughly considering and optimizing packaging systems can avoid food loss and waste. We suggest a number of issues that must be explored and review the associated challenges. Five main issues were recognized through the extensive experience of the authors and engagement of multiple stakeholders. The issues promoted are classified as follows: (1) identify and obtain specific data of packaging functions that influence food waste; (2) understand the total environmental burden of product/package by considering the trade-off between product protection and preservation and environmental footprint; (3) develop understanding of how these functions should be treated in environmental footprint evaluations; (4) improve packaging design processes to also consider reducing food waste; and (5) analyze stakeholder incentives to reduce food loss and waste. Packaging measures that save food will be important to fulfill the United Nations Sustainable Development goal to halve percapita global food waste at the retail and consumer levels and to reduce food losses along production and supply chains.

《产业生态学报》

2019年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12808>

材料回收利用一定能减少垃圾填埋吗?

作者: Trevor Zink, Roland Geyer

关键字: 循环经济、转移、产业生态学、填埋、回收利用、废弃物管理**摘要:**

材料回收利用的支持者通常会指出两个环境效益: 减少处置(垃圾填埋或焚烧)和替代初级生产。但是, 在本文中, 我们从数学上证明, 如果不进行置换, 回收可以延迟但不能阻止任何现有报废材料最终被填埋或焚烧。减少最终被掩埋或焚烧的材料数量的唯一方法是首先减少产量。未生产出来的材料则无需处理。仅通过减少初级生产, 回收利用就有可能减少达到使用寿命的材料量。因此, 回收利用的“双重收益”实际上是其中之一, 而材料回用的环境收益在于它有可能取代初级生产。但是, 由增加的回收利用来替代初级生产是由市场力量驱动的, 并不能保证实现。不恰当的假设所有回收材料都能带来最终处置的减少, 会低估产品系统对环境的影响。这一误差的潜在幅度是巨大的, 尽管对于惰性可回收材料而言, 它比不当假设所有回收材料取代了主要材料生产所引入的误差要低。我们认为, 需要更新生命周期评估产品寿命终止模型, 以免夸大回收利用的好处。此外, 学者和政策制定者应着重寻找和实施增加可回收材料替代潜力的方法, 而不是着眼于处置转移的目标。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12808>

Material Recycling and the Myth of Landfill Diversion

Trevor Zink, Roland Geyer

Keywords: industrial ecology, industrial symbiosis, Linked Open Data, ontology, Semantic Web, social networks**Summary:**

Proponents of material recycling typically point to two environmental benefits: disposal (landfill/incinerator) reduction and primary production displacement. However, in this paper we mathematically demonstrate that, without displacement, recycling can delay but not prevent any existing end-of-life material from reaching final disposal. The only way to reduce the amount of material ultimately landfilled or incinerated is to produce less in the first place; material that is not made needs not be disposed. Recycling has the potential to reduce the amount of material reaching end of life solely by reducing primary production. Therefore, the “dual benefits” of recycling are in fact one, and the environmental benefit of material recycling rests in its potential to displace primary production. However, displacement of primary production from increased recycling is driven by market forces and is not guaranteed. Improperly assuming all recycled material avoids disposal underestimates the environmental impacts of the product system. We show that the potential magnitude of this error is substantial, though for inert recyclables it is lower than the error introduced by improperly assuming all recycled material displaces primary material production. We argue that life cycle assessment end-of-life models need to be updated so as not to overstate the benefits of recycling. Furthermore, scholars and policy makers should focus on finding and implementing ways to increase the displacement potential of recyclable materials rather than focusing on disposal diversion targets.

《产业生态学报》

2019 年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12806>

什么影响了智能手机的二手市场价值? 来自 eBay 的证据

作者: [Tamar Makov](#), [Tomer Fishman](#), [Marian R. Chertow](#), [Vered Blass](#)

关键字:

摘要:

二手产品的再利用可以延长产品的使用期限, 从而减少对环境的影响。通过分析 2015 年和 2016 年 eBay 出售的 50 万台苹果和三星二手智能手机交易记录, 我们研究了哪些产品属性会影响智能手机的保值能力并促进基于市场的再利用。研究表明, 尽管通常情况下, 可修复性和大内存被认为能延长手机使用寿命, 但实际上, 它们对当前智能手机的经济寿命及其基于市场的再利用影响有限。相比之下, 品牌作为一种无形的产品属性, 可以将智能手机的经济寿命*延长 12.5 个月。由于较长的经济寿命意味着较长的使用期限和较长的总体寿命, 该结果显示了利用产品的无形属性促进可持续消费的潜力。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12806>

What Affects the Second-Hand Value of Smartphones: Evidence from eBay

[Tamar Makov](#), [Tomer Fishman](#), [Marian R. Chertow](#), [Vered Blass](#)

Keywords: brand, eBay, reuse, secondhand market, smart phones, use phase

Summary:

Reuse via secondhand markets can extend the use phase of products, thereby reducing environmental impacts. Analyzing 500,000 listings of used Apple and Samsung smartphones sold in 2015 and 2016 via eBay, we examine which product properties affect how long smartphones retain market value and facilitate market-based reuse. Our results suggest that although repairability and large memory size are typically thought to be “life extending,” in practice they have limited impact on the current economic life span of smartphones and their market-based reuse. In contrast, we show that brand, an intangible product property, can extend smartphones’ economic life span by 12.5 months. Because longer economic life spans imply extended use phases and longer life spans overall, these results illustrate the potential of harnessing the intangible properties of products to promote sustainable consumption.

《产业生态学报》

2019 年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12765>

硬盘驱动器的全球流动

量化电子废物回收系统中的价值泄漏概念

作者: Mostafa Sabbaghi, Willie Cade, William Olson, Sara Behdad

关键字: 全球流动分析, 硬盘驱动器, 物质回收, 稀土元素, 复用性, 价值泄漏

摘要:

处于使用/寿命终端的硬盘驱动器 (EoU/L HDDs) 中的剩余值通常难以得到最优回收。对硬盘驱动器的不正确收集和回用不仅会导致全球环境和社会问题日益严重, 而且还会影响经济转型并导致重大价值损失。目前, 对使用过的硬盘驱动器的最优选处理方式是回收其中回收效益最高的金属, 例如钢和铝, 这是通过基于粉碎的回收过程来实现的, 但这种回收方式会导致价值和材料流失。EoU/L HDDs 剩余价值回收的复杂性要求更全面地了解可用于回收的 HDDs 的全球供应图景。本文的目的是首先确定发展中地区和发达地区之间新旧硬盘驱动器跨境全球运输的地理模式, 然后通过引入几个独特的视角来捕捉和量化价值泄漏。已经进行了两项分析。首先, 量化了由于钕 (Nd) 的全球回收水平不足导致的价值损失。其次, 分析了由于 HDDs 的准时回用延迟而导致的价值泄漏。此外, 确定了 HDDs 正确回用的核心挑战, 消费电子产业可以就此做出重大贡献。HDDs 可以为其他电子设备的回用提供重要参考, 因此对 HDDs 回用研究的发现可以用于其他类型的电子设备。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12765>

The Global Flow of Hard Disk Drives: Quantifying the Concept of Value Leakage in E-waste Recovery Systems

Mostafa Sabbaghi, Willie Cade, William Olson, Sara Behdad

Keywords: Global flow analysis, hard disk drive, material recovery, rare earth elements, reusability, value leakage

Summary:

The remaining value within end-of-use/life hard disk drives (EoU/L HDDs) is often not optimally recovered. The improper collection and recovery of HDDs contribute not only to rising environmental and social concerns worldwide, but also to the transformation of the economy and a significant loss of value. Currently, the most preferred treatment option for used hard drives is to recover the metals with the highest recycling effectiveness, such as steel and aluminum, via a shredding-based recycling process that results in both value and material leakages. The complexity of retrieving the remaining values within EoU/L HDDs demands a larger view of the global supply of HDDs available for recovery. The aim of this paper is to first identify the geographical patterns of transboundary global shipments of new and used HDDs between developing and developed regions, and then capture and quantify the value leakage by bringing several unique perspectives. Two analyses have been conducted. First, the loss of value due to the insufficient recovery of neodymium (Nd) at the global level is quantified. Second, the value leakage as a result of the delay on on-time reuse of HDDs is captured. Furthermore, the central challenges toward proper recovery of HDDs, where consumer electronic industry can make significant contributions, have been identified. HDDs are well positioned to contribute important insights to the recovery of other electronic devices, so the findings from HDDs can be adopted for other types of electronics.

《产业生态学报》

2019 年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12810>

生命周期评估中产品系统模型的披露: 实现透明度和隐私保护

作者: [Brandon Kuczenski](#)

关键字: 汇总, 机密信息, 批判性评述, 生命周期评估 (LCA), 产品系统模型, 透明度

摘要:

对生命周期评估 (LCA) 研究进行知识综合面临的许多挑战源于研究作者和读者无法就用于执行 LCA 计算的产品系统模型的结构和内容达成正式共识。本文提供了一个框架, 用于以一种允许读者检查, 验证和复制计算的方式正式公开 LCA 研究的前景, 但前提是读者可以访问与作者相同的生命周期清单和影响特征化资料。该框架还可以用于将研究划分为公共部分和私人部分, 允许对这两个部分进行严格审查, 但在公开内容中省略私人信息。公开内容由六个组件组成, 其中包括模型中实体的三个列表和描述它们的互连的三个稀疏矩阵。实体列表引用了以前发布的资源, 包括背景库存数据库和特征化的基本流程, 并且公开框架要求作者和读者都同意这些引用的含义。该框架有助于产业生态学学科内外不断努力, 以提高学术作品的可复制性和可验证性, 它的应用将为 LCA 结果的分布式、独立于平台的计算和验证指明方向。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12810>

Disclosure of Product System Models in Life Cycle Assessment: Achieving Transparency and Privacy

[Brandon Kuczenski](#)

Keywords: Aggregation, confidential information, critical review, life cycle assessment (LCA), product system models, transparency

Summary:

Many of the challenges facing knowledge synthesis from life cycle assessment (LCA) studies stem from the inability of study authors and readers to formally agree on the structure and content of the product system models used to perform LCA computations. This article presents a framework for formally disclosing the foreground of an LCA study in a way that permits the computations to be inspected, verified, and reproduced by a reader, provided that the reader has access to the same life cycle inventory and impact characterization resources as the author. The framework can also be used to partition a study into public and private portions, allowing both portions to be critically reviewed but omitting the private information from the disclosure. A disclosure is made up of six components, including three lists of entities in the model and three sparse matrices describing their interconnections. The entity lists make reference to previously-published resources, including background inventory databases and characterized elementary flows, and the disclosure framework requires both author and reader to agree on the meaning of each of these references. The framework contributes to ongoing efforts within and beyond industrial ecology to improve the reproducibility and verifiability of scholarly works, and if implemented, plots a course toward distributed, platform-independent computation and validation of LCA results.

《产业生态学报》

2019年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12780>

使用生命周期清单实现 TIMES 综合评估模型 (TIAM-FR) 原材料缺口的闭合

作者: Antoine Boubault, Seungwoo Kang, and Nadia Ma'izi

关键字: Ecoinvent, 能源系统, 综合评估, 生命周期清单, 材料, TIAM-FR

摘要:

综合评估模型通常不受矿产资源供应的限制。本研究介绍了一种材料核算方法, 作为解决 TIMES 综合评估模型 (TIAM-FR 版本) 中原材料缺口的第一步。该方法从 ecoinvent3.3 数据库中获取基于过程的生命周期清单 (LCIs), 并将其归因于构成全球能源系统的 TIAM-FR 技术过程。本研究通过在第二共享社会经济路径 (SSP2) 基准情景中对发电行业在 2010–2100 年时间范围内进行前瞻性演练展示了该方法。本研究首先将 LCIs 分解至三个独立的生命周期阶段 (建设、运营和报废), 并将它们与各自的 TIAM-FR 电力输出 (新容量、电力生产和生命周期终端容量) 相结合, 以估算年度矿产资源需求。本研究对化石燃料以及金属和非金属矿物资源在生命周期各阶段和区域层面 (15 个世界区域) 上的用量进行了动态量化。水电、太阳能和风力发电厂的建设在连续的峰谷期间增加了对金属和非金属矿产资源的使用。然而, 化石燃料的用量一直远远高于矿产资源的用量。最后, 本研究评估了全球材料使用对将一部分基础设施活动停止使用的灵敏度。本方法可以扩展到其他综合评估模型, 也可能扩展到其他能源部门。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12780>

Closing the TIMES Integrated Assessment Model (TIAM-FR) Raw Materials Gap with Life-cycle Inventories

Antoine Boubault, Seungwoo Kang, Nadia Ma'izi

Keywords: Ecoinvent, energy system, integrated assessment, life cycle inventories, materials, TIAM-FR

Summary:

Integrated assessment models are in general not constrained by mineral resource supply. In this paper, we introduce a material accounting method as a first step toward addressing the raw materials gap in the TIMES integrated assessment model (TIAM-FR version). The method consists of attributing process-based life cycle inventories (LCIs) taken from the ecoinvent 3.3 database to the TIAM-FR technology processes constituting the global energy system. We demonstrate the method performing a prospective exercise on the electricity generating sector in a second shared socioeconomic pathway (SSP2) baseline scenario on the 2010–2100 time horizon. We start by disaggregating the LCIs into three separate life phases (construction, operation, and decommissioning) and coupling them to their respective TIAM-FR electric outputs (new capacities, electricity production, and end-of-life capacities) in order to estimate the annual mineral resource requirements. Prospective uses of fossil fuels and metallic and nonmetallic mineral resources are quantified dynamically at the life phase and regional levels (15 world regions). The construction of hydropower, solar power, and wind power plants generate increasing use of metallic and nonmetallic mineral resources in successive peak and valley periods. However, the use of fossil fuels is much higher than the use of mineral resources all along the horizon. Finally, we evaluate how sensitive the global material use is to the allocation of a share of infrastructure activities to the decommissioning phase. This approach could be extended to other integrated assessment models and possibly other energy sectors.

《产业生态学报》

2019 年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12812>

技术选择模型应用于归果型生命周期评价: 秘鲁农业部门案例研究

作者: [Gustavo Larrea-Gallegos](#), [Ian V´azquez-Rowe](#), [Hugo Wiener](#), [Ramzy Kahhat](#)

关键字:

摘要:

在 2030 年, 秘鲁南海岸用于生产皮斯科酒的葡萄需求预计会翻一倍。然而, 这种酒的产区限制了产量, 也限制了农业扩张空间, 可以预见到这些限制将带来潜在的资源竞争。因此, 本研究的目的是了解皮斯科酒销量上升带来的与伊卡河谷和皮斯科地区农业动态发展相关的环境影响, 尤其是气候变化和水资源消耗。为此, 考虑到农业扩张、作物替代、集约化生产等可预见的变化, 研究运用归果型生命周期评价分析了葡萄栽培系统环境影响的相应变化。基于前人归因型环境影响的研究结果, 本研究采用两阶段归果型生命周期评价模型, 其中, 边际效应采用随机技术选择模型进行估计。研究结果表明, 通过作物替代, 伊卡河谷和皮斯科地区的皮斯科酒产量可以得到提升, 同时, 本地温室气体排放和水资源消耗将减少, 然而, 农业生产转移造成的环境影响呈现相反趋势。除了研究结果可以提供政策启示之外, 本研究中提出的研究方法可以用于其他高限制条件的农业系统, 即受地理条件限制的农业系统。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12812>

Applying the Technology Choice Model in Consequential Life Cycle Assessment: A Case Study in the Peruvian Agricultural Sector

[Gustavo Larrea-Gallegos](#), [Ian V´azquez-Rowe](#), [Hugo Wiener](#), [Ramzy Kahhat](#)**Keywords:** agriculture, consequential LCA, GHG emissions, industrial ecology, Peru, pisco**Summary:**

Demand for grapes to produce pisco in southern-coastal Peru is expected to double by 2030. However, the appellation of this beverage confines the production and limits the space for agricultural expansion, leading to a situation in which potential competition for resources with established constraints is foreseen. Hence, the objective of this study is to understand the environmental impacts, focused on climate change and water consumption, linked to the agricultural dynamism in the valleys of Ica and Pisco due to an increase in the demand of pisco. For this, the viticulture system was analyzed regarding predicted changes in terms of expansion, displacement or intensification using a consequential life cycle assessment (CLCA) approach, identifying the environmental consequences of these shifts. A two-step CLCA model was used based on the results of a previous attributional study, in which marginal effects were estimated following the stochastic technology-of-choice model (STCM) operational framework. Results identified a potential for the increase of pisco production based on crop substitution in the valleys of Ica and Pisco and suggest that greenhouse gas emissions and water consumption will be reduced locally, but the displaced agricultural production would reverse this tendency. Regardless of the policy implications of the results in the analyzed system, the proposed methodology constitutes a robust methodology that can be applied to other highly constrained agricultural systems, namely, those regulated by geographic indications.

《产业生态学报》

2019年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12762>

从 SLCA 到积极的可持续性绩效评估

一个双重德尔菲分析

作者: Michael Kühnen, Rüdiger Hahn

关键字: 德尔菲分析, 产业生态学, 组织有效性理论, 状态评价, 积极可持续性表现, 社会效益

摘要:

生命周期可持续性评价 (LCSA) 目前专注于捕获和修复评价对象的不良性能, 而不是促使其正面效益的扩大化, 从而有利于人类生活质量的提高及可持续发展。为了克服这种失衡, 本文旨在将产业生态学的视角转向积极可持续性绩效评价。我们认为, 积极绩效可以从社会生命周期评价方面来发展, 因为可持续发展是一个以人类为中心的概念, 它将人类福祉的正面利益 (即可持续性的社会维度) 置于分析的中心。然而, SLCA 的领域非常分散, 没有统一的理论理解, 也没有明确研究的首要问题和未来的研究方向。因此, 我们与来自学术界和实践领域的专家进行了广泛的德尔菲分析, 旨在探讨从社会生命周期评估中 (SLCA) 获得的经验教训, 以实现积极可持续绩效评估 (PSPM)。这样有助于对这两个相互关联的领域有一个更加连贯和深入的理解。研究结果显示, SLCA 已成为抵御声誉威胁的一种风险防御型管理工具, 而 PSPM 则提供了衡量可持续发展的积极效益和管理积极贡献的渠道。我们为统一 SLCA 和 PSPM 的讨论确定了三个主要挑战 (定义、方法和管理) 和两个主要利益相关领域 (组织和社会), 从而为未来的研究提供了有效途径。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12762>

From SLCA to Positive Sustainability Performance Measurement: A Two-tier Delphi Study

Michael Kühnen, Rüdiger Hahn

Keywords: Delphi study, industrial ecology, organizational effectiveness theory, performance measurement, positive sustainability performance, social performance

Summary:

Life cycle sustainability assessment (LCSA) currently has a preoccupation with capturing and repairing negative dysfunctions and pathologies instead of fostering positive features that make a human life sustainable and worth living. With the intention to overcome this imbalance, this paper aims at transferring the shift to a positive sustainability performance measurement (PSPM) perspective in industrial ecology. We argue that positive performance is likely to develop from the lens of social life cycle assessment (SLCA), because sustainability is an anthropocentric concept that puts positive benefits to human well-being (i.e., the social dimension of sustainability) at the center of the analysis. However, the field of SLCA is highly fragmented, without a coherent theoretical understanding and without a clear prioritization of problems and future research directions. Therefore, we engage in an extensive Delphi study with experts from academia and practice to foster a discussion of lessons learned from SLCA for PSPM. In this way, the paper contributes to a more coherent and deeper understanding of both connected fields. The results emphasize that SLCA has become a defensive risk management instrument against reputational damages, whereas PSPM offers the potential to proactively measure and manage positive contributions to sustainable development. We identify three main challenges (definitional, methodological, and managerial) and two main areas of benefits (organizational and societal) and use them to consolidate the debate on SLCA and PSPM and to provide a roadmap for future research.

《产业生态学报》

2019 年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12766>

应用物质流分析和生命周期评估的 2050 年日本木材使用环境影响评估

作者: Chihiro Kayo, Sébastien M.R. Dente, Chika Aoki-Suzuki, Daisuke Tanaka, Shinsuke Murakami, and Seiji Hashimoto

关键字: 气候变化, 产业生态学, 土地利用, 生命周期评估 (LCA), 物质流分析 (MFA), 材料替代

摘要:

在本研究中, 我们使用物质流分析和生命周期评估来量化 1970 年至 2013 年日本木材消耗所造成的环境影响和影响的削减量。然后, 我们基于林业、木材和能源使用的多种未来情景, 对 2050 年环境影响和削减量进行了预测。我们使用了一种包含特征描述、损害评估、货币化的影响评估方法, 并且以日元 (JPY) 来表示结果。我们发现, 纸张消费对气候变化和城市空气污染的环境影响很大, 占 1970 年至 2013 年环境影响总量的 56% 至 83%。因此, 减少纸张生产中的温室气体, 氮氧化物和二氧化硫排放将是减少整体环境影响的有效措施。建筑施工、土木工程、家具材料和能源生产的木材使用量增加可能使 2050 年环境影响减少 (通过碳储存, 材料替代和燃料替代) 达到 3570 亿日元, 相当于 2013 年水平的 1.68 倍。特别是在建筑结构中用木制品代替水泥、混凝土、钢等材料可以明显地减少环境影响。虽然木材消耗量的增加可以减小气候变化、资源消耗和城市空气污染等环境影响, 但木材消耗量的增加会带来相应的土地荒漠化问题。因此, 避免森林砍伐带来的土地贫瘠显得尤为重要。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12766>

Environmental Impact Assessment of Wood Use in Japan through 2050 Using Material Flow Analysis and Life Cycle Assessment

Chihiro Kayo, Sébastien M.R. Dente, Chika Aoki-Suzuki, Daisuke Tanaka, Shinsuke Murakami, and Seiji Hashimoto

Keywords: climate change, industrial ecology, land use, life cycle assessment (LCA), material flow analysis (MFA), material substitution

Summary:

In this study, we used material flow analysis and life cycle assessment to quantify the environmental impacts and impact reductions related to wood consumption in Japan from 1970 to 2013. We then conducted future projections of the impacts and reductions until 2050 based on multiple future scenarios of domestic forestry, wood, and energy use. An impact assessment method involving characterization, damage assessment, and integration with a monetary unit was used, and the results were expressed in Japanese yen (JPY). We found that environmental impacts from paper consumption, such as climate change and urban air pollution, were significant and accounted for 56% to 83% of the total environmental impacts between 1970 and 2013. Therefore, reductions of greenhouse gas, nitrogen oxide, and sulfur oxide emissions from paper production would be an effective measure to reduce the overall environmental impacts. An increase in wood use for building construction, civil engineering, furniture materials, and energy production could lead to reductions of environmental impacts (via carbon storage, material substitution, and fuel substitution) amounting to 357 billion JPY in 2050, which is equivalent to 168% of the 2013 levels. Particularly, substitution of nonwooden materials, such as cement, concrete, and steel, with wood products in building construction could significantly contribute to impact reductions. Although an increase of wood consumption could reduce environmental impacts, such as climate change, resource consumption, and urban air pollution, increased wood consumption would also be associated with land-use impacts. Therefore, minimizing land transformations from forest to barren land will be important.

《产业生态学报》

2019年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12764>

发展中国家, 环境及可持续政策, 产业生态学, 物质流分析, 国家物质流核算, 不确定性

作者: Xaysackda Vilaysouk, Heinz Schandl, Shinsuke Murakami

关键字: 发展中国家, 环境及可持续政策, 产业生态学, 物质流分析, 国家物质流核算, 不确定性

摘要:

现代环境和可持续发展政策肯定了社会经济过程与环境压力 and 影响之间的联系, 并力求通过政策设计将经济活动与环境压力 and 影响分离, 因此需要一个复杂而全面的知识库作为支撑。工业代谢的概念提供了良好的概念基础, 物质流核算, 包括主要材料输入和废弃物和排放的流出, 提供了广泛接受的操作基础。然而, 针对国民经济综合物质流账户的研究很少, 尤其是对发展中国家而言。老挝人民民主共和国 (Lao PDR 或 Laos) 等国家的发展面临双重目标, 即在可持续地管理自然资源和减少资源吞吐量不断增加带来的不利环境影响的同时, 提升人民的物质生活水平。本研究填补了知识空白, 全面介绍了老挝国民经济的物质投入和废弃物排放, 并将核算方法应用于亚洲的低收入经济体。我们展示了2000年和2015年的物质平衡。本研究中, 我们采用了老挝国家统计局数据和欧洲统计局 (Eurostat) 核算准则的数据, 开创了物质流数据作为官方统计报告一部分的先河。我们阐明了核算方法的可行性, 并采用产业生态学中常用的统计方法进行不确定性分析来讨论结果的稳健性, 包括高斯误差传播原理和蒙特卡洛模拟。我们发现, 老挝国家层面物质流、废弃物和排放快速变化的规模和构成对现有政策能力构成了挑战, 需要投资开展对物质利用, 废物处理和排放变化模式的管治。我们认为现有数据分析足以稳健支撑政策方向的变化。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12764>

A Comprehensive Material Flow Account for Lao PDR to Inform Environmental and Sustainability Policy

Xaysackda Vilaysouk, Heinz Schandl, Shinsuke Murakami

Keywords: Developing countries, environmental and sustainable policy, industrial ecology, material flow analysis (MFA), national material flow accounting, uncertainty

Summary:

Modern environmental and sustainability policy that acknowledges the linkages between socioeconomic processes and environmental pressures and impacts, and designs policies to decouple economic activity from environmental pressures and impacts, requires a sophisticated and comprehensive knowledge base. The concept of industrial metabolism provides a sound conceptual base, and material flow accounting—including primary material inputs and outflows of waste and emissions—provides a well-accepted operationalization. Studies presenting a comprehensive material flow account for a national economy are rare, especially for developing countries. Countries such as Lao People's Democratic Republic (Lao PDR or Laos) face dual objectives of improving the material standard of living of their people while managing natural resources sustainably and mitigating adverse environmental impacts from growing resource throughput. Our research fills a knowledge gap, presents a comprehensive account of material inputs and outflows of waste and emissions for the Lao PDR national economy, and applies the accounting approach for a low-income economy in Asia. We present a material balance for the years 2000 and 2015. For this research, we used data from Lao PDR national statistics and the accounting guidelines of the European Statistical Office (Eurostat), which pioneered the use of material flow data as part of its official statistical reporting. We demonstrate the feasibility of the accounting approach and discuss the robustness of results using uncertainty analysis conducted with statistical approaches commonly used in the field of industrial ecology, including Gauss's law of error propagation and Monte Carlo simulation. We find that the fast-changing scale and composition of Lao PDR material flows, waste, and emissions presents challenges to the existing policy capacity and will require investment into governance of changed patterns of material use, waste disposal, and emissions. We consider the data analysis sufficiently robust to inform such a change in policy direction.

《产业生态学报》

2019年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12773>

道路物质存量估算: 越南案例研究

作者: Thi Cuc Nguyen, Tomer Fishman, Alessio Miatto, Hiroki Tanikama

关键字: 建筑材料, 发展中国家, 物质存量, 道路网, 交通基础设施, 越南

摘要:

本研究是一项开创性的工作, 研究量化了发展中国家越南的道路网中的物质存量, 并分析了其与越南近年来经济发展之间的关系。国家道路网作为资产和基础设施投资, 是国家发展的必要催化剂, 同时道路网需要获取大量建筑材料进行扩建和维护, 从而对环境产生影响。然而, 迄今为止, 尤其是在发展中国家, 关于这一主题的研究很少。我们编制了2003年-2013年国家及省级越南公路的物质存量和流量账户, 发现大约40%的国内建筑材料消费用于扩建和维护道路网, 道路网中的物质存量从2003年的13.21亿吨增加到2012年的26.6亿吨。物质存量增长率与这一时期的国内生产总值(GDP)增长率非常相似, 这表明物质基础设施发展和经济发展具有相互依存关系。在省级层面, 特别是考虑到城市中心车辆激增的情况, 我们的结果显示了当地的库存差异及其支持客运和货运的能力差异。通过展示在发展中国家开展物质流量和存量分析面临的挑战, 本研究不仅揭示了越南的运输物质存量及其政策影响, 而且还可作为在类似国家进一步开展工作的参考案例。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12773>

Estimating the Material Stock of Roads: The Vietnamese Case Study

Thi Cuc Nguyen, Tomer Fishman, Alessio Miatto, Hiroki Tanikama

Keywords: Construction materials, developing countries, material stock, road network, transport infrastructure, Vietnam

Summary:

This study is a pioneering effort to quantify the materials stocked in the road network of a developing country, Vietnam, and analyze its relationships to the country's recent economic development. National road networks function as capital and infrastructure investments that are necessary catalysts for countries' development, while requiring the extraction of vast amounts of construction materials for expansion and maintenance causing environmental impacts. However, there has so far been little research on the subject, especially in developing countries. We compile material stock and flow accounts for Vietnam's roads from 2003 to 2013 on the national and provincial levels, finding that approximately 40% of the domestic consumption of construction materials is for expanding and maintaining the road network, and the materials stocked in the road network doubled from 1,321 million metric tons in 2003 to 2,660 million metric tons in 2012. Material stock growth rates closely resembled those of gross domestic product (GDP) in this period, suggesting a codependency of physical infrastructure development and economic development. On the provincial level, our results show local disparities in the stock and its capacity to support the transportation of passengers and freight, especially considering the surging growth of vehicles in urban centers. By showcasing the challenges of conducting a material flow and stock analysis in a developing country, this study not only sheds light on Vietnam's transportation material stock and its policy implications, but also serves as a case study for further work in similar countries.

《产业生态学报》

2019年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12776>

对非正式城市的衡量：社会代谢途径

作者: Suzanne Smit, Josephine K. Musango, Zora Kovacic, Alan C. Brent

关键字: 非正规住区, MuSIASEM, 社会代谢, 南非, 城市代谢, 城市贫民窟

摘要:

城市非正规住区或贫民窟的快速增长对平衡发展和环境目标构成了特殊挑战。在南非, 高度不平等、贫穷和失业导致了大范围的移民。然而, 进城务工人员的涌入却极少与适当的住房和基础设施相匹配, 导致城市非正规住区的形成和发展。尽管贫民窟现象持续存在, 却很少有研究可以提供对将非正规居住区和非正规经济链接到更广泛的城市环境和城市经济的代谢过程的深刻理解。因此, 本文使用对社会和生态系统代谢方法的多尺度综合评估来审查 Enkanini (南非 Stellenbosch 的一个城市非正规住区) 的人类活动和土地利用。研究结果强调了一些问题, 这些问题的解决需要借助于空间、发展和地方经济等方面的政策, 例如需要改善非正规住区和城区之间的运输链接。对 Enkanini 内居民的时间使用情况的分析结果表明, Enkanini 是周边地区劳务的净提供者。此外, 地理测绘表明 Enkanini 是一个小型但充满活力的非正规经济体, 同时严重缺乏水、废物和卫生基础设施。此外, 讨论了本研究在理论、方法学、社会和政策方面的关键影响, 包括对进行定期数据收集和分析的城市观测站的需求。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12776>

Towards Measuring the Informal City: A Societal Metabolism Approach

Suzanne Smit, Josephine K. Musango, Zora Kovacic, and Alan C. Brent

Keywords: Informal settlement, MuSIASEM, societal metabolism, South Africa, urban metabolism, urban slum

Summary:

The rapid growth of urban informal settlements, or slums, poses a particular challenge for balancing developmental and environmental goals. In South Africa, high levels of inequality, poverty, and unemployment contribute to widespread migration. The influx of migrant workers to cities, however, is rarely matched with adequate housing and infrastructure, resulting in the formation and growth of urban informal settlements. Despite the persistence of the slum phenomenon, very few studies provide an in-depth understanding of the metabolic processes that link these spaces, and informal economies, to the broader urban environment and economy. This article therefore utilized a multiscale integrated assessment of the societal and ecosystem metabolism approach to examine human activity and land use in Enkanini, an urban informal settlement in Stellenbosch, South Africa. The results highlight a number of issues to be addressed through spatial, developmental, and local economic policy, such as the need for improved transport linkages. The time-use results show that Enkanini is a net provider of labor to the surrounding area. Further, geographical mapping indicates Enkanini as a small, but vibrant, informal economy, while being grossly underserved in terms of water, waste, and sanitation infrastructure. Key implications are discussed in terms of the theoretical, methodological, societal, and policy impact of the study, including the need for city observatories that conduct regular data collection and analysis.

《产业生态学报》

2019 年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12778>**媒介城市的代谢分析：法国雷恩和勒芒的物质流分析、内地贸易区和物流中枢功能**作者: [Jean-Baptiste Bahers](#), [Sabine Barles](#), [Mathieu Durand](#)

关键字: 城市, 内地贸易区, 媒介城市, 物质流分析, 空间化, 城市代谢

摘要:

尽管近年来城市代谢已重新引起了研究者的关注, 但在世界范围内的相关研究仍然是碎片式的。大多数研究针对的是主要城市(如特大城市和/或国家首都), 针对媒介城市、中等或小城市开展的研究较少。然而, 城市化趋势表明, 伴随着大都市化进程的另一个城市化特征是媒介城市的激增。

我们研究了 2012 年两个法国媒介城市的城市代谢: 雷恩市(40 万居民)和勒芒市(20 万居民)。为此, 我们基于欧盟统计局制定的方法开展了物质流分析(MFA), 并进行了一定调整以适应地方层面的研究。研究中首次使用有关货运的精确统计资料来实现这一目标。我们开发了一种多尺度方法, 以衡量这两个城市的城市代谢, 并将其与其他案例和较大的地区进行比较。从而可以更好地了解媒介城市的特定地域代谢, 其内地贸易区以及物流中枢功能。我们从社会代谢中“城市维度”视角出发, 基于多尺度方法, 对有关物流中枢、去物质化和领土自治的争论焦点进行了讨论。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12778>**Urban Metabolism of Intermediate Cities: The Material Flow Analysis, Hinterlands and the Logistics-hub Function of Rennes and Le Mans (France)**

Jean-Baptiste Bahers, Sabine Barles, Mathieu Durand

Keywords: Cities, hinterland, intermediate cities, material flow analysis, spatialization, urban metabolism

Summary:

Although urban metabolism has been a subject of renewed interest for some years, the related studies remain fragmented throughout the world. Most of them concern major cities (megacities and/or national capitals) and, more rarely, intermediate, medium-sized or small cities. However, urbanization trends show that together with the metropolization process, another one is characterized by the proliferation of intermediate cities.

We have studied the metabolism of two French intermediate cities for the year 2012: Rennes Métropole (400,000 inhabitants) and Le Mans Métropole (200,000 inhabitants). To this end, we used material flow analysis (MFA) based on the methodology developed by Eurostat, adapted to the subnational level. This has been made possible by the use, for the first time, of very precise statistical sources concerning freight. We have developed a multiscale approach in order to weigh the urban metabolism of those two cities and to compare it to other cases and larger territories. This allows a better understanding of the specific territorial metabolism of intermediate cities, their hinterlands, and their logistics-hub function. We conclude with the “urban dimension” of social metabolism, and, thanks to the multiscale approach, to the debate regarding logistical hubs, dematerialization, and territorial autonomy.

《产业生态学报》

2019 年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12772>

创客空间内熔融沉积式打印机能源和材料使用的不确定性和可变性

作者: [Ruoyu Song](#), [Lee Clemon](#), and [Cassandra Telenko](#)

关键字: 增材制造, 能源使用, 生命周期清单, 材料效率, 不确定性, 废物产生

摘要:

台式熔融沉积式 (FDM) 打印机因体积小、价格实惠而广受欢迎。如果未来台式 FDM 打印机如传统打印机一样遍布学校和办公室, 那么这些机器将会消耗大量的能源和材料。然而, 评估 FDM 打印机的环境影响非常困难, 因为打印机的品牌和类型很多, 而且在不同情景下会使用不同的打印材料。本研究使用来自两个不同打印地点的数据来评估 FDM 打印机能源和材料平衡的情景和参数不确定性及可变性。来自两个创客空间的数据提供了四种打印机分别使用聚乳酸和丙烯腈丁二烯苯乙烯 (ABS) 时的材料消耗和能耗情况。使用实际性能数据可以进一步研究废料率。回归分析可以深入了解能源和材料消耗的预测因素。蒙特卡罗模拟揭示了台式 FDM 打印机的能源生命周期清单值的范围。从回归结果来看, Type A Pro 是能耗最高的打印机。在材料浪费方面, 使用 ABS 的开放式创客空间与较高的废品率相关联。回归分析表明, 材料使用率并不是废料率的强预测因子。两个站点产生的废物量表明, 更普遍的 FDM 打印访问可能会对废物流产生重大影响。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12772>

Uncertainty and Variability of Energy and Material Use by Fused Deposition Modeling Printers in Makerspaces

Ruoyu Song, Lee Clemon, and Cassandra Telenko

Keywords: Additive manufacturing, energy use, life cycle inventory, materials efficiency, uncertainty, waste generation

Summary:

Desktop-grade fused deposition modeling (FDM) printers are popular because of compact sizes and affordable prices. If we are moving toward a future where desktop FDM printers are in every school and office, like conventional printers, then these machines will consume a large amount of energy and material. However, it is very difficult to evaluate the environmental impacts of FDM printers since there are so many different brands and types of printers using different raw materials under different scenarios. This study uses data from two different printing sites to evaluate the scenario and parameter uncertainty and variability in energy and material balances for FDM printers. Data from the two makerspaces provide insight into the material and energy consumption data using polylactic acid and acrylonitrile butadiene styrene (ABS) with four types of printers. The use of actual performance data allowed for the additional study of scrap ratio. Regressions provide insight into predictive factors for energy and material consumption. Monte Carlo simulations show the range of energy life cycle inventory values for the desktop-grade FDM printers. From the regressions, Type A Pro was the most energy-intensive machine. For material waste, an open-access makerspace using ABS was associated with higher scrap ratio. Regression analysis indicates that the rate of material usage is not a strong predictor of waste rates. The amount of waste generated across both sites indicates that more ubiquitous access to FDM printing may create a significant addition to the waste stream.

《产业生态学报》

2019 年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12774>

将电池整合到未来的瑞士供电系统一项归果型环境评估

作者: Laurent Vandepaer, Julie Cloutier, Christian Bauer, Ben Amor

关键字: 电力存储, 能源系统模型, 产业生态学, 磷酸铁锂, 边际电力供应混合, 前瞻性环境评估**摘要:**

预计 2030 年后, 固定型蓄电池将在瑞士电力系统中发挥作用。通过整合间歇性可再生能源的剩余生产, 储能单元取代了不同来源的电力生产, 并可能创造环境效益。然而, 在电池制造过程中以及原材料提取中也会对环境产生重大影响。本研究对锂金属聚合物和锂离子固定型蓄电池开展了前瞻性归果型生命周期评估 (LCA), 旨在量化潜在的环境效益和缺陷。相关预测被整合到 LCA 模型中: 能源情景用于模拟边际电力供应混合; 关于电池性能和回收过程的预测来自文献。对关键参数和方法选择在结果中的作用进行了系统的研究。结果表明, 边际电力来源的替代决定了使用电池对环境的影响。在代表当前政策的参考情景中, 被置换的电力混合以天然气联合循环机组为主。在这种情景下, 在被评估的 16 种影响类别中, 电池的使用对 12 种影响产生了环境效益。然而, 当电池在低碳情景下被集成到供电系统中时, 可实现的环境效益会显著降低, 因为用电池替代的边际电力生产已经降低了环境影响。电池的直接影响主要来自于消耗电力的上游生产过程和与铜和铝土矿等材料开采相关的活动。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12774>

Integrating Batteries in the Future Swiss Electricity Supply System: A Consequential Environmental Assessment

Laurent Vandepaer, Julie Cloutier, Christian Bauer, Ben Amor

Keywords: Electricity storage, energy system model, industrial ecology, lithium iron phosphate, marginal electricity supply mix, prospective environmental assessment**Summary:**

Stationary batteries are projected to play a role in the electricity system of Switzerland after 2030. By enabling the integration of surplus production from intermittent renewables, energy storage units displace electricity production from different sources and potentially create environmental benefits. Nevertheless, batteries can also cause substantial environmental impacts during their manufacturing process and through the extraction of raw materials. A prospective consequential life cycle assessment (LCA) of lithium metal polymer and lithium-ion stationary batteries is undertaken to quantify potential environmental benefits and drawbacks. Projections are integrated into the LCA model: Energy scenarios are used to obtain marginal electricity supply mixes, and projections about the battery performances and the recycling process are sourced from the literature. The roles of key parameters and methodological choices in the results are systematically investigated. The results demonstrate that the displacement of marginal electricity sources determines the environmental implications of using batteries. In the reference scenario representing current policy, the displaced electricity mix is dominated by natural gas combined cycle units. In this scenario, the use of batteries generates environmental benefits in 12 of the 16 impact categories assessed. Nevertheless, there is a significant reduction in achievable environmental benefits when batteries are integrated into the power supply system in a low-carbon scenario because the marginal electricity production, displaced using batteries, already has a reduced environmental impact. The direct impacts of batteries mainly originate from upstream manufacturing processes, which consume electricity and mining activities related to the extraction of materials such as copper and bauxite.

《产业生态学报》

2019年, 第23卷 第3期

<http://dx.doi.org/10.1111/jieec.12814>

促进产业协同的社会语义 Web 框架

作者: Mohamed Raouf Ghali, Jean-Marc Frayret

关键字: 产业生态学, 产业共生, 链接开放数据, 本体, 语义网, 社会网络

摘要:

产业协同将两个或两个以上组织进行结合, 这些组织起初作为独立的经济参与者, 可能来自不同的部门, 协同的目的是为了共享资源并交换副产品, 为参与者带来共同的环境、财务和社会利益。产业共生 (IS) 是可以通过各种方式随时间推移启动和创建的产业协同网络。在实践中, 产业协同增效的启动, 尤其是副产品兼容性的确定, 依赖于直接或便利化的知识和信息共享, 这对于发现产业协同增效机会至关重要。社会语义网 (SSW) 除了在促进组织之间的知识和信息共享方面可能做出贡献外, 还具有通过系统地自动识别并向潜在合作伙伴推荐副产品交换兼容性来促进产业协同的潜力。该框架利用了语义网的功能, 可以搜索区域内与世界各地现有的产业协同可类比的潜在合作伙伴。本文提出了用于产业协同增效的社会语义网 (SSWISI) 框架, 用于产业协同增效的启动。本文提出的框架采用链接开放数据 (LOD) 的概念, 该概念允许与外部系统共享和交换信息。此功能在启动产业协同方面将所提议的框架与现有方法区分开。

Journal of Industrial Ecology

2019, Vol. 23, Issue 3

<http://dx.doi.org/10.1111/jieec.12814>**"Social Semantic Web Framework for Industrial Synergies Initiation**

"

Mohamed Raouf Ghali, Jean-Marc Frayret

Keywords: industrial ecology, industrial symbiosis, Linked Open Data, ontology, Semantic Web, social networks

Summary:

Industrial synergies join two or more organizations that initially functioned as independent economic actors—that may originate from different sectors—together in order to share resources and exchange by-products for mutual environmental, financial, and social benefits for its participants. Industrial symbioses (ISs) are networks of industrial synergies that can be initiated and created over time in various manners. In practice, the initiation of an industrial synergy, and particularly the identification of by-product compatibilities, relies on direct or facilitated knowledge and information sharing, which is essential for discovering industrial synergy opportunities. Beyond its potential contribution to facilitate knowledge and information sharing among organizations, the Social Semantic Web (SSW) also has the potential to facilitate the initiation of industrial synergy by systematically and automatically identifying and recommending by-products exchange compatibilities to potential partners. This framework exploits the ability of the semantic web to enable the search for analogies between potential partners within a region or district and existing industrial synergies around the world. This paper proposes the Social Semantic Web for Industrial Synergies Initiation (SSWISI) framework for the initiation of industrial synergies, which is based on the Social Semantic Web. The framework proposed in this paper adopts the concept of Linked Open Data (LOD), which enables the sharing and exchanging of information with external systems. This feature distinguishes the proposed framework from the existing approaches in its initiation of industrial synergies.