

ANNUAL REPORT 2007

Indicator Framework for Eco-Efficiency (IFEE) – Consortium

RESEARCHERS OF THE CONSORTIUM

Partner 1: *Åbo Akademi University (ÅA), Coordinator of the consortium:*

Dr. Jouni Korhonen, Academy Fellow

Mr. Olavi Holmijoki, Researcher, M.Sc. (Tech.), PhD student

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Ms. Eeva-Lotta Apajalahti, Research trainee, M.Sc. (Economics) student

Katariina Björninen, Research Manager

Partner 2: *Turku School of Economics and Business Administration, Finland Futures Research Centre (FFRC):*

Jarmo Vehmas, Dr., Senior Researcher

Jyrki Luukkanen, Dr., Professor

Jari Kaivo-oja, Dr., Research Director, Doctoral Researcher (Academy of Finland)

Marileena Koskela, M.Sc. (Eng.), PhD student

Partner 3: *Technical Research Centre of Finland (VTT)*

Ilkka Savolainen, Dr., Research Professor, Docent (Adjunct Professor)

Ms. Johanna Kirkinen, Ph.D student

Partner 4: *University of Helsinki (HU)*

Pekka Kauppi, D.Sc., Professor

Laura Saikku, M. Sc., Ph.D student

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UPDATED SYNOPSIS OF THE PROJECT

Many metrics and indicators exist to evaluate eco-efficiency (EE) of products, processes, organisations, or of larger systems. EE is defined as *units of value generation per unit of environmental influence*. EE applications that are not strategic and lead to problem shifting have been recently observed. We use the strategic sustainable development model (SSD) constructed in consensus by ten pioneering sustainability scientists. The aim of SSD is to prevent problem shifting and problem displacement when different sustainability concepts and approaches are used. *The objective is to develop an indicator framework for eco-efficiency*. Six hypotheses on the limitations of EE are considered in an explorative conceptual analysis of EE against SSD. Different EE indicators are studied to learn how they can be used in the evaluation of the six hypotheses. We apply the results in ‘what if?’ scenarios with case study data from VTT Finland, Statistics Finland, Finland Futures Research Centre, mainly from the forest industry of Finland. In case of each hypothesis, the results are transformed into criteria producing the indicator framework. The framework enables parallel and complementary use of different indicators to study where and how EE can be applied and where it cannot be applied.

PUBLICATIONS AND PRESENTATIONS

Articles published and accepted in peer-reviewed international scientific journals

Korhonen, J. 2007. Environmental Planning VS. Systems Analysis: Four Prescriptive Principles VS. Four Descriptive Indicators. *Journal of Environmental Management*, Vol 82, Issue 1, pp. 51-59.

Hoffrén, J. and Korhonen, J. 2007. Eco-efficiency is important when it is strategic. *Progress in Industrial Ecology* 4 (1-2): 1-18.

Hoffrén, J. and Hellman, J. 2007. Impacts of Increasing consumption on Material Flows over Time: Empirical Evidence from Finland 1975-2005. *Progress in Industrial Ecology* 4 (6): 463-483.

Saikku, L., Rautiainen, A., Kauppi, P.E. 2008. The sustainability challenge of meeting carbon dioxide targets in Europe by 2020, *Energy Policy* 36 (2), 731-743. Accepted 10 October 2007

Tapio, P., D. Banister, J. Luukkanen, J. Vehmas and R. Willamo 2007. Energy and transport in comparison: Immaterialisation, dematerialisation and decarbonisation in the EU15 between 1970 and 2000. *Energy Policy* 35:1, 433-451.

Vehmas, J., Luukkanen, J. and J. Kaivo-oja 2007. Linking analyses and environmental Kuznets curves for aggregated material flows in the EU. *Journal of Cleaner Production* 15:7, 1662-1673.

Manuscripts submitted to peer-reviewed international scientific journals

Hoffrén, J. and Apajalahti, E. 2007. Emergent Eco-efficiency Paradigm in Corporate Environment Management. *Sustainable Development*. Submitted: 5 Oct 2007.

Kirkinen, J., Palosuo, T., Holmgren, K., Savolainen, I. Greenhouse impact due to the use of combustible fuels – life-cycle viewpoint and Relative Radiative Forcing Commitment. Submitted for review.

Vehmas, J. 2007. Decomposition analysis of CO₂ emissions from fuel combustion in selected countries. Invited paper to a Special Issue in *International Journal of Environmental Technology and Management*, ed. by P. Nijkamp and D. Constantin. Submitted 21.12.2007.

Edited international journals applying the referee-practice

Korhonen, J. Editor in Chief, *Progress in Industrial Ecology, an International Journal*. 6 issues in 2007.

Korhonen, J. (Guest Editor). 2007. A Special Issue: From Material Flow Analysis to Material Flow Management. *Journal of Cleaner Production* 15 (17): 1585-1742.

Hoffrén, J. (Guest Editor). 2007. Special Issue on Strategic Eco-efficiency. *Progress in Industrial Ecology, an International Journal*. 4 (1&2).

Other publications

Holmijoki, O. 2007. Puuteollisuus, sen toimintaympäristö ja laskelmia kehitysvaihtoehtoista. Teknillinen korkeakoulu. Puunjalostustekniikan osasto. Puutekniikan laboratorion tiedonanto 101. 170 s. ISBN 978-951-22-9070-3 (pdf).

Holmijoki, O., Paajanen, T., Kairi, M. 2007. Puuteollisuuden nykytilan ja haasteiden arviointia. Teknillinen korkeakoulu. Puunjalostustekniikan osasto. Puutekniikan laboratorion tiedonanto 102. 67s. ISBN 978-951-22-9071-0 (pdf). ISBN 978-951-22-9072-7.

Dannemand Andersen, P., Borup, M., Borch, K., Kaivo-oja, J., Eerola, A., Finnbjörnsson, T., Overland, Eriksson, E. A., Malmér, T. & Mölleryd, B. A. 2007. Foresight in Nordic Innovation Systems. Nordic Innovations Centre. Oslo. Norway. 58 pages

Conference presentations

Saikku, L. & Lehtonen T. J. 2007. Rantasalmi Eco-Industrial Park: An “Ecological” Eco-Industrial Park Project in Finland. Eighth Finnish Conference of Environmental Sciences, Mikkeli, 10-11 May 2007. Poster presentation.

Kaivo-oja, J. 2007. Energy Markets and Sustainability Challenge: Alternative Energy Utility Scenarios and Strategies. Poster Paper Presentation. Moscow Energy Week. October 23—26, 2007. Moscow. 2d International Energy Week "Moscow Energy Dialogue". Conference CD-ROM. Moscow. 3 pages.

Kaivo-oja, J. 2007. Future Trends and Insights to Smart Working Tools, Environments and Instruments in Automobile and Electronic Industries. ISTMA2007 World Assembly Conference. University of Joensuu. Joensuu. CD-ROM. 10 pages.

Haukioja, T. & Kaivo-oja, J. 2007. Do U.S. and EU-15 Countries Meet the Kyoto Targets till 2012? Exploring Numbers and Narratives for U.S. and European Energy and Climate Policies. Paper in the Conference Proceedings CD-ROM. From Oracles to Dialogue. Exploring New Ways to Explore the Future A COST Action A22 Conference, National Technical University, Athens, Greece, 9-11 July 2007. 27 pages.

OTHER ACTIVITIES

Press releases

“Expanding Forests Key to Meeting EU Climate Change Goal for 2020” related to Energy Policy article (Saikku et al 2008) was published on roughly 60 media websites in six languages across 16 countries.

Organised International Scientific Conferences

The ÅA partner participated in arranging the 13th Annual International Sustainable Development Research Conference in Västerås, Sweden, June 10-12, 2007. Dr. Korhonen was the co-chair of the conference.

The Consortium is also one of the main partners of the International Sustainable Development Research Society (ISDRS)¹. The leader of the Consortium, Dr. Korhonen, is the President of the society. The consortium is working intensively for the Society's 14th Annual International Sustainable Development Research Conference, New Delhi, India, September 21-23, 2008 ².

Finland Futures Research Centre, Turku School of Economics was active partner in final COST22 conference "From Oracles to Dialogue", in July 2007, at the Technical University of Athens, Greece. Dr. Kaivo-oja was in the management committee of this international conference and disseminated his energy scenario research in a special session of COST A22 (foresight methodologies). He was also full member of management committee of the COST A22, CORDIS network.³

Domestic Scientific Conferences

The leader of the consortium, Dr. Korhonen, runs the Finnish Society for Industrial Ecology as its chair, Ms. Pihlatie at the Åbo Akademi group is the secretary ⁴. Dr. Hoffrén and Dr. Vehmas are members of the Society's board. The Society has arranged two conferences in 2007. One conference was held in Jokioinen and Forssa with some 140 participants and one in Lahti with some 270 participants.

Research visits

PhD Student Johanna Kirkinen (VTT partner) is currently on a six month (1.10.2007 onwards) research visit at Management Development Institute (MDI) in India, New Delhi.

Dr. Korhonen has made two research visits to the University of Hong Kong, De la Salle University Manila, and MDI for the above noted activities including the international science society (ISDRS), Ms. Kirkinen's research visit, PIE, JCP.

Dr. Rupert Baumgartner from Leoben University in Austria was working as a visiting Professor for two months at Åbo Akademi University. His work was related to IFEE project's themes such as eco-efficiency analysis and assessment of environmental impacts of organization networks. He met and gave presentations to the IFEE partners.

Editorial activities (peer-reviewed international scientific journals)

Dr. Korhonen is the Editor-in-Chief of Progress in Industrial Ecology (Inderscience Publishers), the Associate Editor of Journal of Cleaner Production (Elsevier Science) and a member of the editorial board of Business Strategy and the Environment, Sustainable Development, Corporate Social Responsibility and Environmental Management and the International Journal of Innovation and Sustainable Development.

Professor Savolainen is the Assistant Editor of Progress in Industrial Ecology. Dr. Hoffrén, Dr. Vehmas and Dr. Luukkanen are members of the editorial board of Progress in Industrial Ecology. Professor Kauppi is a member of the editorial board of Environmental Science and Policy (Elsevier Science).

Dr Kaivo-oja was Special Editor of Technological Forecasting and Social Change (TFSC) Special Issue "Seeds of Change" in 2007 together with Dr Sandro Mendonca (University of Sussex, UK & ICTEC, Lisbon, Portugal). Dr. Kaivo-oja managed Special Issue Edition process of 8 scientific articles.

Referee activities (peer-reviewed international scientific journals)

Dr. Korhonen has reviewed about 50 scientific articles to Progress in Industrial Ecology (Editor-in-Chief), Journal of Cleaner Production (Associate Editor), Business Strategy and the Environment, Sustainable Development, Corporate Social Responsibility and Environmental Management and the International Journal of Innovation and Sustainable Development (Member of the editorial board).

¹ ISDRS website <http://www.isdrs.org>

² Conference website <http://www.14aisdrc2008.com>

³ <http://www.costa22.org/>

⁴ Society website <http://www.teollinenekologia.fi>

Dr. Hoffrén has reviewed two scientific articles to Progress in Industrial Ecology during 2007 relating to Eco-efficiency research.

Dr. Vehmas has reviewed four scientific articles to the International Journal of Environmental Technology and Management (IJETM) and one scientific article to the International Journal of Green Energy (IJGE).

Dr. Kaivo-oja has been a reviewer in Energy Policy (EP) in September 2007. He has also been an expert reviewer of the Preparatory Action for Security Research (The PASR programme of 7th Framework Programme), (7 research proposals) European Commission, DG Enterprise and Industry, June 2007.

Reviewer activities

Dr. Korhonen has served as the international examiner of a PhD course in Industrial Ecology (course code IØ8503) at Norwegian University of Science and Technology (NTNU) in Trondheim.

Vehmas, J. 2007. Pre-examiner statement of a manuscript for a doctoral thesis by Varho, V.: Calm or Storm? Wind Power Actors' Perceptions of Finnish Wind Power and its Future. University of Helsinki, Faculty of Biosciences. Submitted 23.7.2007.

Vehmas, J. 2007. Pre-examiner statement of a manuscript for a doctoral thesis by Rosenström, U.: Sustainable Development indicators: Much Wanted, Less used? University of Helsinki, Faculty of Biosciences. Submitted 10.4.2007 and a second version 27.7.2007.

PROGRESS MADE IN RELATION TO THE PROJECT PLAN

Eco-efficiency (EE) applications that are not strategic and lead to problem shifting were observed by the IFEE-consortium. *IFEE aims to develop an indicator framework for eco-efficiency.*

Work supporting the research objective has now included conceptual analysis of industrial ecology, eco-efficiency and ecological economics (conceptual) comparison aired/debated in a double special issue on the theme edited by our consortium (ÅA partner)⁵. We have also performed comparative scenario simulations on the materials and energy flows of the Finnish industrial sectors including the principal focus area of forestry and forest industry, and published international 'stage setting' articles on them (FFRC partner)⁶. The HU partner has recently received information on the acceptance of their paper in *Energy Policy* (Elsevier Science, acceptance letter October 2007). In the paper the Helsinki University team analysed the eco-efficiency of energy production in European Union in relation to carbon dioxide emission during 1993-2004 looking at dematerialisation and decarbonisation efforts required to achieve EU27 emission targets. Thus we have worked for the subsequent parts of the research work of the IFEE consortium during the first part of the research agenda.

The international nature of the IFEE consortium has been enhanced by the IFEE team arranging a 6 month research visit of the VTT partner's researcher (Ph.D student enrolled at Åbo Akademi) Ms. Johanna Kirkinen to MDI India. This collaboration enhances the IFEE-research proposal anticipated Finnish—Asia cooperation. The IFEE consortium is organizing the 14th Annual International Sustainable Development Research Conference of the International Sustainable Development Research Society (ISDRS) in India and the event naturally has special tracks and sessions on indicators, on sustainable development, and on the vision to generate an overall framework for different sustainable development indicators.

Turku, January 15, 2008

Jouni Korhonen

⁵ See Edited international journals: Hoffrén, J., Guest Editor (Korhonen, J., Editor-in-Chief), Special Issue on Strategic Eco-efficiency. Progress in Industrial Ecology, an International Journal. Vol 4 Nos 1&2

⁶ See Articles published: Vehmas, J., Luukkanen, J. and Kaivo-oja, J. 2007. Linking analyses and environmental Kuznets curves for aggregated material flows in the EU. Journal of Cleaner Production 15:7, 1662-1673.