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Dematerialization across scales: Measurements, empirical evidence, future options

Dematerialization and Sustainable Degrowth

Research Framework for a Fair and Ecological Economic Degrowth

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World unsustainability and inequity: the responsibility of the North

Fifteen years ago only a few people in intellectual and activist circles were trying to alert the public to the reality of environmental degradation and life support destruction on earth. Today there is a wide consensus. To mention just one relevant reference, the Millennium Ecosystem Assessment states that: “Human activity is putting such strain on the natural functions of Earth that the ability of the planet’s ecosystems to sustain future generations can no longer be taken for granted (…). Nearly two thirds of the services provided by nature to humankind are found to be in decline worldwide. In effect, the benefits reaped from our engineering of the planet have been achieved by running down natural capital assets”[1].

World ecosystems are not only seriously affected, nor are just world economies and societies. There is a danger for the survival of humanity, for conditions favourable to life. In addition to species extinction and sharp decline in biodiversity, let us mention destruction of forests impairing photosynthesis capacity, degradation and loss of arable land, chemical pollution, over-accumulation of nutrients, destruction of the protective ozone layer, water shortages, risks to climate stability…

More precisely, the expressions "human activity" and "engineering of the planet" quoted in the Millennium Ecosystem Assessment, challenge the model of production and consumption that are used in Western Europe and in the United States of America and its current worldwide utopian extension. Added to the gravity of the ecological crisis are the obvious high levels of economic and social inequality worldwide. In 1998 the UNDP[2] reported on levels of consumption in the OECD countries compared to the rest of the world. According to this report, 20% of the human population consumes 48% of all the planet’s meat, 66% of all energy, 72% of all electricity, 76% of all petroleum and 86% of all the automobiles. Valued in

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[1] Millenium Ecosystem Assessment, Living Beyond our Means, Natural Assets and Human well-being, statement from the board, , coordinated by UNEP, 2005. *Called for by United Nations Secretary-General Kofi Annan in 2000, this assessment involved the work of more than 1,360 experts worldwide. Each part of the assessment has been scrutinized by governments, independent scientists, and other experts to ensure the robustness of its findings.* http://www.millenniumassessment.org/en/index.aspx

[2] UNDP Human Development Report 1998 Oxford University press

economic terms, inhabitants of OECD countries are responsible for 86% of all the consumption purchases in the world. The development of general ecological studies based on Life Cycle Assessment of products and services[3] (or the "ecological rucksack"[4]) has played a role in making us aware of the enormous hidden side of western consumption: the numerous indirect impacts of our increasingly globalised economy. The necessity of preventive approaches lead to the development of resource extraction indicators - namely total material, energy and land extraction – that enabled the analysis of large systems. Schmidt-Bleek disseminated the idea of a “factor 10” dematerialization in the North if one wishes to combine world equity and sustainability [5].

From "sustainable development" to "eco-economy": major questions remain.

These insights, which are shared today by many authors from diverse backgrounds (academics, journalists, writers, activists...), inevitably raise questions about needed changes in our present production and consumption activities which cause increasing resource extraction, material flows and waste. For many years and in response to the work of the club of Rome, the only alternative being talked about came under the heading of “Sustainable Development”. This expression was officially presented in the Bruntland report[6] and was ultimately adopted within all UN commissions. It can be defined as: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

However, it quickly became apparent that this definition, the result of an international political compromise, suffered from very important ambiguities. Although the concept may still be interpreted in an appropriate way, the generalization of the rhetoric around "Sustainable development" to include a whole set of activities which still pose problems for ecosystems, has resulted in the expression slowly losing credibility. Therefore the concept of “sustainable development” can hardly be used as a real guide for action. An informative report produced by the French senate[7] several years ago, already highlighted the ambiguity of the expression and its lack of rigour, which appeared, paradoxically, to contribute to its success. The repeated use of the formula in order to justify very diverse array of economic practices has almost reduced it to an artificial rhetorical tool. Criticisms of the expression "Sustainable Development" have gradually led to the following fundamental question: Is it possible for developed countries to continue their trajectory of economic growth (i.e. annual growth in the value of the goods and services produced and consumed), while satisfying their stated objective of reducing the ecological impact of their economic activities?
A majority of researchers and practically all university economists (at least French-speaking), answer this question affirmatively. Economic growth and development in the North would guarantee continuation of technical innovations thus ensuring a greater technical efficiency - i.e. less consumption of natural resources, less emissions, a reduction of energy intensity per unit of economic product (better insulated households, less polluting vehicles etc). This technical development would guarantee a "decoupling" between on the one hand, extraction and waste and, on the other hand, economic valorisation of goods and services produced and exchanged (economic growth remaining an entrenched unalterable assumption). This position is supported in various manners. For example, new theories of industrial evolution

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[3] SETAC, Life Cycle Assessment. *Workshop report, Postdam, Germany.* Bruxelles, Belgique : SETAC-Europe, 1992, 90p.
[4] Schmidt-Bleek, Das MIPS konzept. (MIPS concept, Material Input Per unit of Service). Weniger Naturverbrauch – mehr Lebens Qualität durch Faktor 10. München: Droemer. 1998
[5] Friedrich Bio Schmidt-Bleek, The Fossil makers, 1993 ISBN 3-7643-2959-9 Birkhäuser, Basel, Boston, Berlin
[6] Brundtland report, Our Common Future, Oxford University Press, 1987
[7] Rapport d’information 224 – tome I (2001-2002) – Parliament office of assessment of technical and scientific choices.

propose “know-how”, “knowledge” and experience as well as "entrepreneurial capital" as immaterial factors of production in modern societies. Many authors also insist on the fact that modern economies are mainly made up of service activities that are less wasteful of energy than industrial activities. Such a position should be confronted with two major objections:

1) A factual objection: efficiency improvements in the North have not reduced its gigantic share of global resource extraction

The significant development of more efficient technologies and services in the last decades has not created absolute reduction in the enormous level of resource extraction driven by developed countries. Domestic extraction of material is stable while per capita consumption of energy and land-use continues to increase in all large developed countries[8]. Moreover a large part of these countries’ contribution is likely to be missing unless one takes into account indirect consumption related to delocalisation of production linked to economic globalisation. Global trade volumes of manufactured products still grew by a factor of 5 in the last thirty years[9]. As mentioned in the last report of the European Environment agency on sustainable use and management of natural resources[10]: “the trend has been to reduce domestic extraction of raw materials and meet the demand through increased imports (…), even if national statistics on consumption of resources show declining figures, environmental burdens may just have been shifted to developing countries, where labour may be cheaper and environmental standards less strict”. In conclusion, even a “relative decoupling” between physical resource extraction and economic value has not been proven. The fact is that efficient technologies and services do not solve world ecological and social problems to a sufficient level– or at least not when they occur in the context of economic growth of the North.

2) A theoretical objection: the rebound effect

The description of the "rebound effect"[11][12][13] and the link between this effect and economic growth[14] constitutes a major objection. Advocates of only ever greater technical efficiency seem to have a difficult time dealing with it.
The "rebound effect" occurs when monetary savings associated with improvement in energy (or material or land-use) efficiency actually favour an increased use of the good or a redeployment of consumption and productive investment in other activities, possibly strongly consuming resources. In the end, far from having reduced the global ecological impact, a local decrease of resource use will lead to an overall growth of energy consumption, material flows, or inappropriate space use elsewhere. The "rebound effect", as defined in the literature, can occur within the sector considered (ex: improvements of motor vehicles encourages the increase of kilometres travelled); it can also support a modification of the productive structure (other sectors of economic activity are thus favoured and possibly over-

[8] Among much available literature let us mention: Eurostat 2002, Material Use in the European Union 1980-2000; MOSUS report, www.mosus.net; OECD in Figures - 2005 edition, ISBN 9264013059; EEA, *Household consumption and the environment* – Report 11-2005.
[9] World Trade Organisation 2005
[10] EEA, Sustainable Use and Management of Natural Resources, 2005
[11] Mathias Binswanger, Technological progress and sustainable development: what about the Rebound Effect? Ecological Economics 36 (2001) 119-132
[12] Christer Sanne, Dealing with environmental savings in a dynamical economy- how to stop chasing your tail in the pursuit of sustainability, Energy Policy, 2000, 28 (6-7): 487-96.
[13] François Schneider, Fritz Hinterberger, Roman Mesicek, Fred Luks, *ECO-INFO-SOCIETY: Strategies for an Ecological Information Society*, dans “Sustainability in the Information Society", Hilty, M.L., P.W.Gilgen (Eds.), part 2, p.831-839, Metropolis-Verlag, Marburg, 2001.
[14] François Schneider, *L’effet rebond*, (rebound effect) l’Ecologiste, French Edition of The Ecologist, n°11 October 2003, Vol 4, n°3, p45

stimulated by a rise in consumer demand and by increased capital formation and investment).

The description of a "rebound effect" associated with diversion of activity makes it possible to understand why the "absolute" decoupling between economic growth and consumption of resources (and hence pollution emitted), so much awaited in our developed economies, does not take place. The technical efficiency liberates productive capital that will inevitably seek, in a growth economy, to be valorised within the same sector (growth in the intensity of use), or invested in other production-consumption activities. As a consequence, the rebound effect brings into question the very basis of such an economy.

Economic growth again up for debate

Criticism of our economic growth-based society is not new; it is even possible to say that it finds its origins in economic development itself. Its intellectual bases (philosophical, religious...) as well as its methods of expression (popular movements, intellectual publications...) were quite varied. However, within the western intellectual arena, such critics have been eclipsed in recent decades following an intellectually fruitful period in the 1960s[15]. The extent of the present ecological and social crisis has inevitably brought a revival of such criticisms.

Very briefly, here are some of the critical approaches:

1) Criticism of economic indicators (Gross Domestic Product, Gross National Product) as a gauge of societal health.

This resulted in the development of various alternative indicators more attuned to discerning the true "wealth" of society.

It is possible to distinguish:

- Indicators aiming to supplement and thus to put into perspective, the monetary value of activities through parameters of a social nature (elimination of illiteracy, social inequalities, access to education...) or of an ecological nature without the need to convert each one into a monetary value.

  Some, like the Human Development Indicator, combine several variables with economic growth. Others are developed in parallel with economic indicators. They include: aggregated indicators of extraction level (TDE - Total Domestic Extraction), aggregated indicators of material consumption (TMR - Total Material Requirement; DMC - Domestic Material Consumption; TMC[16] - Total Material Consumption), and more elaborate indicators taking into account the differences between material flows such as EMC[17]... Other equivalent indicators exist based on the consumption of energy and/or space, like the popular mass-communication adapted “Ecological Footprint” as developed by

[15] Donella H Meadows et al., The Limits to growth, Club of rome, New York: Universe Books, 1972.
[16] EUROSTAT, 2001. Economy-wide Material Flow Accounts and Derived Indicators. A Methodological Guide. Statistical Office of the European Union, Luxembourg.
[17] Ester van der Voet, Lauran van Oers, Stephan Moll, Helmut Schütz, Stefan Bringezu, Sander de Bruyn, Maartje Sevenster, Geert Warringa, Policy Review on Decoupling: Development of indicators to assess decoupling of economic development and environmental pressure in the EU-25 and AC-3 countries, CML, Wuppertal institute, CE solutions, ISBN: 90-5191-143-2, CML report 166, Department Industrial Ecology

Wackernagel[18], or like the more accounting-related versions of "Land resource uses". Finally there are Indices of ecological vulnerability.

- Economic indicators that incorporate positive and negative monetary values on the basis of ecological and social sustainability.

Economic costs to society in the form of environmental degradation (in the broad sense, in terms of health, criminality, etc.) are subtracted from the economic valuation of the economy. This approach, due to its being founded on serious methodological work, leads to convincing results. These "Indices of well-being" challenge the valorisation process by showing that a large part of a purely economic indicator value does not correspond to improvement of societal living conditions but to a partial valorisation of the loss of well-being (lack of accounting for the monetary expenses of: clean-up costs, medical care, repair, remediation, etc.)[19].

2) Global assessments independent of national accounting. These include the LCA (Life Cycle Assessment) of products, Substance Flow Analyses that attempt to study all flows of a substance within a given area, and MIPS. All these approaches are related to ideas of dematerialization of products and services and to sustainable consumption. Global energy and land-use accounting can help us analyse specific products and services too.

3) "Bio-economic" approaches which take as a starting point the work of Georgescu-Roegen or, in France, René Passet. These viewpoints integrate the material limits of an economic activity. This school is largely represented in publications in the journal of Ecological Economics. These limits-to-growth approaches developed in tandem with expert reports warning of the imminence of production peaks for oil and gas.

4) Approaches arising from new practices in the varied field of social experiments, in particular the strong localisation of certain economic activities, including “green” and “social” currencies such as LETS and complementary currencies, the use of direct co-operatives for the distribution of certain products, barter, organic agriculture etc.

5) Lastly, within French-speaking literature in particular, many approaches have developed under the heading "criticism of development". These originate in the work of anthropologists, sociologists and historians, and elucidate the social and cultural cataclysm produced by economic modernity. Interdisciplinary analyses of consumer society (for example sociology, philosophy...) are an integral part of this critical analysis of "commercial modernity". [20][21]

In their diversity, these approaches show the social, cultural and environmental limits of our economic growth-based society. The research program Research & Degrowth explicitly intends to draw the theoretical and practical conclusions of such work. We think that the facts are so sufficiently established as to justify theoretical and practical explorations of degrowth.

For a framework of Research and Degrowth

[18] Wackernagel M, Rees W, 1996, Our ecological footprint – reducing Human Impact on the earth. Gabriola Island/Philadelphia: New Society.
[19] Jean Gadrey et Florence Jany-Catrice, Les nouveaux indicateurs de richesse, La découverte (Repères), Paris, 2005
[20] Let us cite Ellul, Charbonneau, Illich, Sachs, Partant, Latouche, Grinevald…
[21] Bernard, Cheynet, Clémentin (Ed) Objectif Décroissance, Parangon 2003

The core of the proposed Research and Degrowth framework can be presented in the following way:

The efforts being made to increase material-, energy- and land-use efficiency must be sustained and thus call for an increase in certain productive investments such as wind turbines, public transportation, etc. These will have a positive impact on the natural ecosystems on which we entirely depend, only on in the condition that they are integrated in a physical de-growth (that is, a reduction of the goods and services produced and consumed). In a market economy this would result in a decrease of values and a reduction of the money in circulation, i.e. an "economic degrowth".

Fair and ecological physical growth is impossible.
Fair and ecological economic growth is too risky considering the rebound effect.
We propose to explore the feasibility of a Fair and Ecological Economic Degrowth.

The opportunities for work of such a prospect are considerable. By challenging the constraint of economic growth a new frontier is opened for research and practice:

1) On a theoretical level, an economic model has yet to be developed in accordance with such an approach. Economic theories of a "stationary state" are the closest to this; they contain the conclusion that any stationary state in a capitalist economy was only a "textbook assumption"[22].

What are the theoretical implications of "Economic Degrowth"?
Does it make sense to describe an ecological, frugal, and sober society in economic terms? Or does appropriate economic degrowth necessarily imply "another society" so making irrelevant our economic value measuring tools? According to the various scenarios that will be elaborated, what types of degrowth could be considered? How would degrowth actually enable avoidance of crisis and disasters? Which economic sectors, which populations would be directly or indirectly concerned? What would be the requirements to re-orient our economy to a sustainable level of consumption? What would adequate indicators consist of?[23] What would be the correct methods of eco-social impact allocation?[24] [25]. A theoretical analysis of the rebound effect and of the means to prevent it will also constitute an important primary research element.

2) On a practical level, many approaches have to be integrated into degrowth to avoid the rebound effect, i.e. within the framework of an absolute reduction -and not only relative- of the ecological impacts. Can we support such practices and question their context? With regard to practices which support eco-efficiency, the following are relevant:

- the "Society Metabolism"[26] which supports reductions of material flows, stocks and waste by setting up co-operation between production and consumption activities
- LCA and MIPS
- Eco-efficiency at the regional level[27]

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[22] Michel Lutfalla, L'état stationnaire, Gauthier-Villars, Paris, 1964
[23] João Rodrigues, Tiago Domingos, Stefan Giljum, François Schneider , *Designing an indicator of environmental responsibility* Ecological Economics – 2005
[24] Schneider, F., Chevalier, J. & Navarro, A. *ACV: Méthodes d'affectation.* (LCA : allocation methods) Techniques de l'ingénieur. Traité Génie industriel G 5 550. April 1998, 16p.
[25] Huppes, G. & Schneider, F. (Eds). *Proceedings of the European Workshop on Allocation in LCA.* Leiden, Pays-Bas, CML, Bruxelles: SETAC, Fév 1994, 174p.
[26] AYRES, R.U. (89) Industrial metabolism. *Technology and environment.* Ausubel J.H. et Sladovich H.E., Washington D.C., USA : National academy press, 1989, p.23-49.
[27] Hinterberger, F., Bamberger, K., Manstein, C., Schepelmann, P., Schneider, F. and Spangenberg, J., *Eco-efficiency of regions, Vienne:* SERI, Novembre 2000, 30p. (www.seri.at/regions.htm)

- Sustainable consumption in its eco-efficient, environmental enhancement, version

At the of sufficiency level, many experiments where economic exchanges are localised have already been developed or are in project stage. Are they condemned to being restricted to small groups of individuals and simple economic exchanges (recycling, cooperation, local vegetable production) or is it possible to build more elaborate scenarios with local actors focussing on energy (local resources for heating systems, co-generation...), on food (for example the possibility of "100% organic" for Brittany raised by the House of Organic Agriculture...), on travel, etc. Do such practices require new financial instruments in order to support their emergence? Which economic actors (Small and Medium Enterprises, associations, co-operatives) should be fully implicated? How will public and politics be involved? How could we support strong sustainable consumption i.e. integrating these aspects of frugality?[28]

3) Which approaches should be developed to give advice to citizens, officials and enterprises?

The inter-working and mediation between different elements and actors in society to support the elaboration and application of various solutions is of primary importance. For example eco-taxes reinvested in more socially equitable alternatives, participation in “open localization” or “sustainable consumption”, reorganisation of employment scenarios including job sharing, decrease and fair allocation of remunerated work. It is a question of working out the best choices to reduce costs while at the same time reducing pollution and working hours, but without exporting the problems elsewhere. We have to find the democratic and participative path that leads in a balanced manner, to a reduction in consumption, a reduction in global production, and to an equitable sharing of working hours so that nobody is excluded. These approaches will strive to establish links with development policies and the problems faced by the Global South.

We ask, when will Sustainable Degrowth in OECD countries become an objective of international intergovernmental organisations?

"Research & Degrowth" will seek to develop an inter-disciplinary expertise to support theoretical and practical research for a fair and sustainable economic degrowth.

If you are interested to support us or to become member of the scientific committee of Research and Degrowth, please contact us at contact@degrowth.net.

[28] Doris A. Fuchs and Sylvia Lorek, Sustainable Consumption Governance: A History of Promises and Failures, Journal of Consumer Policy (2005) 28(3): 261-288