1. Post-growth economics

1.6. Social metabolism, industrial ecology, and the new industrial revolution

A case study of bio-regional social metabolism

Relocalization of the economy has often been advocated as a key leverage to make our societies more environmentally and socially sustainable (Frankova et Johanisova 2012). The reasons generally put forward include in particular : cutting down the energy embedded in transportation, creating resilient social relationships, and improving environmental justice.

Indeed, by dissociating the places of production, consumption and consummation, globalization tends to invisiblize the environmental and social consequences of western societies lifestyles. This leads to hidden deforestation, land-grabbing, work made of tedious and repetitive task and so on : outsourcing undignified working conditions and environmental ills that would not be acceptable if it were to affect family members, friends or neighbours. On the contrary, increasing the share of local goods and services in our production and consumption habits may induce qualitative changes in our relationships with other fellow workers, our tools and with our environment.

However, relocalizing raises many questions : how much of relocalizing? Of which kind of production? What kind of dependencies may remain due to local scarcity/uneven geographic distribution of resources and territorial and social specifics?
Building on a regional case study, this paper aims at shedding some light on the biophysical constraints imposed upon production and consumption of the regional economy, bringing quantitative elements to the debate by apprehending the use of energy and materials.
The goal of this research is to provide a first assessment of the discrepancy between the metabolic scale of the economy of the region and the biophysical capacity of the corresponding territory.

We will therefore exploit the concept of social metabolism, that studies materials and energy flows and links it to the social organization. Social metabolism shows a wide range of spatial scales that can go from a village to a global worldwide analysis. The choice of an administrative region is ambitious because it deals with both urban and rural metabolism and their complementarity.

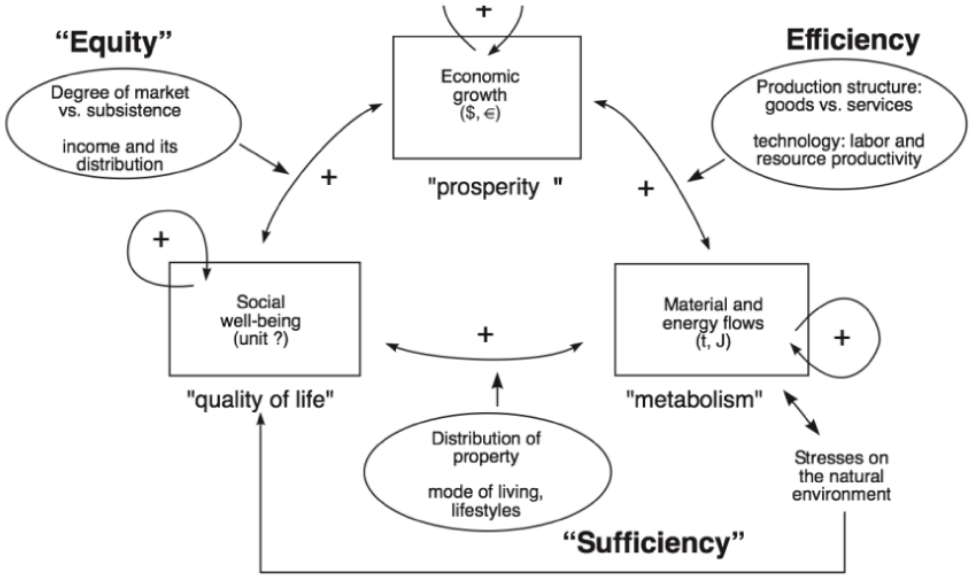

Figure 1: Interrelations of material and energy flows, economic growth, and social well-being. Source: (Fischer-Kowalski et Haberl 1998), taken from (Haberl et al. 2004)

According to the MEFA (Material and Energy Flow Analysis) framework, three types of decoupling can be identified : equity based on the link between economic growth and social well-being, efficiency based on the link between economic growth and metabolism and the last one called sufficiency, on which we will focus, based on the link between metabolism and quality of life.

The territory selected for our case study is the French administrative region "Pays de la Loire".
The choice to realize this case study on this particular region originates from a political interest in transforming the energy system and a social project that (re)defined regional indicators of progress in a deliberative process. The objective is to confront these innovative initiatives to the biophysical and social reality provided by social metabolism.

One of the specificity of the region Pays de la Loire comes from its position as the second agricultural region in France. Hence the highest regional emitting sector in terms of greenhouse gases is the agriculture with 43% of the total (Explicit, 2009).
The region relies heavily on trade for its energy supply. 1.6% of its primary energy consumption is produced within the region and 0.9% comes from renewable resources (mostly from wood). The territory depends mainly from fossil fuels exporting countries. And the electricity, at 80% imported from other French regions, representing 23% of final energy use is made from uranium coming from Niger and used in nuclear power plants as fuel.

Following (Sorman et Giampietro 2013), we will divide the different metabolic structures expressing societal functions in two parts :

(i) A hypercyclic part - the part generating a net surplus of energy for the rest of the society, and
(ii) A purely dissipative part - the part providing control, which is dissipating the energy surplus

Once the current metabolism assessed, we try to determine the biophysical capacity of the regional territory. We will here draw from Herman Daly's strong sustainability pillars (Daly 1990).

1. For renewable resources, the rate of harvest should not exceed the rate of regeneration;
2. For pollution, the rates of waste generation from projects should not exceed the assimilative capacity of the environment;
3. For nonrenewable resources, the depletion should require comparable development of renewable substitutes for that resource.

In this perspective, we quantify the regional potential of energy, matter and capacity to absorb pollution that we can get on the territory.

Concerning the first pillar, we should keep in mind the danger of an anthropocentric vision of maximizing the flux of biomass coming from some renewable resources and consider inter-species balance.
As for pollution, qualitative and quantitative aspects will be taken into account. Is there a "safe" level of nuclear waste production? Or what is the degree of climate justice that will be used to define a fair carbon budget are important ethical questions to ask.
About the third pillar, it means that part of the revenue from nonrenewable resources should be spent to ensure new sustainable sources that will completely substitute for the depleted resources. This criterion is closer to weak sustainability than to strong sustainability and we will carefully pay attention to the limits of substitution of resources.

If oversized according to these limits, scaling the local economy to a sustainable level would then require an "economic degrowth" meaning a downscaling of the current size and pattern of socio-economic systems. Degrowth may then refer to a society with a smaller metabolism, but also, and more importantly, to a society with a metabolism which has a different structure and serves new functions. This does not mean an homothetic degrowth, less of the same, but questioning the place of different economic sectors, especially those which are resources/energy intensive.

This metabolic analysis will conclude on the investigation of the viability of different scenarios of local development, such as the one proposed by Virage Energie Climat, a regional association that adapted the national scenarios of energetic transformation from Negawatt (national association) and agricultural transformation called Afterres from Solagro (national association with 25 employees created 30 years ago) or the official regional plan.
Some sectors highlighted by this social metabolism case study may follow a managed decline and the question raised for the future is to examine how to prevent social suffering and what should be the pace of this phasing out.

Our results demonstrate that the metabolism of the region studied overpasses the biophysical limits of the territory, and, in the perspective of locally reaching a sustainable scale, highlight the need for a form of selective degrowth. This raises the question of the pace of the transformation and the possibility to conciliate social sustainability and environmental right scaling and achieve a prosperous way down (Odum 2001), especially in a context of lock-in due to existing built infrastructures and powerful vested interests.

References

Daly, Herman E. 1990. « Toward some operational principles of sustainable development ». *Ecological Economics* 2 (1): 1‑6. doi:10.1016/0921-8009(90)90010-R.

Fischer-Kowalski, Marina, et Helmut Haberl. 1998. « Sustainable Development: Socio-Economic Metabolism and Colonization of Nature ». *International Social Science Journal* 50 (158): 573‑587. doi:10.1111/1468-2451.00169.

Frankova, Eva, et Nadia Johanisova. 2012. « Economic Localization Revisited ». *Environmental Policy and Governance* 22 (5): 307‑321. doi:10.1002/eet.1593.

Haberl, Helmut, Marina Fischer-Kowalski, Fridolin Krausmann, Helga Weisz, et Verena Winiwarter. 2004. « Progress towards sustainability? What the conceptual framework of material and energy flow accounting (MEFA) can offer ». *Land Use Policy*, Land use and sustainability Indicators, 21 (3): 199‑213. doi:10.1016/j.landusepol.2003.10.013.

Odum, Howard Thomas. 2001. *A prosperous way down principles and policies*. Édité par Elisabeth C. Odum. Boulder (Colorado): University Press of Colorado.

Sorman, Alevgul H., et Mario Giampietro. 2013. « The energetic metabolism of societies and the degrowth paradigm: analyzing biophysical constraints and realities ». *Journal of Cleaner Production*, Degrowth: From Theory to Practice, 38 (janvier): 80‑93. doi:10.1016/j.jclepro.2011.11.059.