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Ecology traditionally focused on isolated, pristine patches of nature; on a planet with seven billion humans and encroaching technosphere, an approach destined for economic, political –and ecological– irrelevancy (McNeill 2000, 335 in Daly & Farley 2010, pp. xx). Direct way to tackle the **misfires of traditional ecology** would be to devise ecological actions which are at the same time economical. To investigate this direct approach of making ecology economical (and, eventually, economy ecological) **we will analyze some working models** of profitable, ecologically-considerate businesses: the Chicago food factory; small-agriculture from Peru; and envelopes plant from France. Discussing these examples, we identify certain **key principles** which make all these enterprises long term economical. Notably, the relationships of: an enterprise's diversity and its economic resiliency; of zero waste policies and social investment of the returns; and of affordances of the local environment and business' long term economic viability. Consequently, we argue for a **conceptualization of ecological management reflecting the nested pillars approach** to UN's sustainable development goals (economy, as a part of society, as a part of its environment (Griggs et al. 2013)). The conceptualization builds up on the idea that economies are holons in the ecosphere (Rees 2004) and by retrofitting our conceptual framework through which we identify our resources and values, as a way to a non-autistic (i.e. holistic), bio-inspired approach to management (cf. Daly & Farley 2010). Namely, according to the advance biological knowledge, it is impossible to make a clear organism/environment distinction, and analyze organisms in isolation of their environment. This fact, which pertains also to humans, makes the ecology theoretically inseparable from the society and its economical actions, and makes environment an active party in social investment policies (Mathews 2011). We investigate whether **ecological management can contribute to the transformation to the circular economy** without government interventions, and can **the question of the purpose of the economy** be, al-

though unanswered at the theoretical level (Zwier et al. 2015), answered on a local level instigated by relatively small business enterprises.

Three examples of ecological management

In the first example, an industrial symbiosis of sixteen food and education businesses from Chicago, known as The Plant, shows how urban agricultural production and food preparation and education can be incorporated into temperate cities, utilizing the existing industrial building stock and urban infrastructure. A brewery, greenhouse, commercial kitchen, bakery, education center and other food businesses are all intertwined in their resource streams (wastes or outputs of one being the inputs for another), and the entire collaborative community making resource-loops with the city of Chicago by utilizing its food waste and providing food, energy and social impact in return. The material flow analysis (based on the law of conservation of matter and energy) is utilized to evaluate management on more than simply financial grounds – on the basis of resource flows, but also regarding the social impacts, as part of the broader sustainability impacts of the facility (Chance et al. 2018).

The second example concerns a segment of classic permaculture from Peru (Altieri et al. 1988). It is prompting a form of management (and technological innovation) focused on design instead of on engineering, on organization instead of on control of nature (cf. Crutzen & Schwägerl 2011). In these agro-systems replicating the natural ecosystems we vividly experience the idea that management can be aptly used to characterize other than human behavior (Dibben & D’Arcy 2015). PC actually uses natural species to ‘manage’ parts of agro-systems – and can be described as management of these natural ‘managers’. If we understand management as a ‘Universal aspect of Purposeful Life’ we can indeed not only inspire our business practices by specific forms of animal and plant type of management (Dibben & D’Arcy 2015), but, furthermore, use these natural managers as sub-governors of our business enterprises.

Our final example will illustrate this point in a more industrial setting, in the case of Pochecho, envelopes plant in northern France. It’s a business devoted to their version of the three principles

of circular economy: the reduction of harsh working conditions; the reduction of negative environmental impact; and increase in productivity (Pochecho)¹. Its main features are: active minimalization of waste and waste-recycling inside the factory; incorporation of animal and plant breeding for food, fuel, and specific waste management tasks (e.g. bamboos as waste-water cleaners); and rejection of financial capitalism (the company's results are systematically reinvested in the company, without paying dividends).

Emergent principles of ecological management

Resilience

The key conceptual framework engulfing all the examples is **resilience** - the capacity of an enterprise to absorb disturbance. It is a framework for understanding how persistence and transformation coexist in living systems, including human societies (Scheffer 2009). It includes not only a diversity which creates a resilient economy (in the form of many small to medium size businesses (Folke 2011)), but, more importantly, the **diversity inside an enterprise** (by many interconnected projects). This strengthens not only general economic stability, but also the local social stability, which further increases enterprise's resilience and capacity to sustain itself.

Material Flow Analysis

Instead of focusing on profit and growth, ecological management focuses on both the sustainability of **resource-flows and on qualitative social development** (Chance et.al 2018). On the basis that superficial human management produces long term weak socio-economic basis (by the motto 'there is no farming without farmers'), it results in, holistically looking, inefficient management. The focus is not only about properly *using* the employees, it concerns their quality of living broadly understood (like the organic food production for employees and similar policies), and not on the circular flow of money, but on the thermodynamically irreversible flows of matter and energy (Rees 2003). As many examples of local currencies show (e.g. the Bristol pound), the material flow analysis is circumventing the financialization focus of classical economics

¹ Notice the resemblance of their focus with permaculture's focus on people, environment, and fair share.

Nested hierarchy

Theoretical background for this focus is the **nested hierarchical relationship** of the economy, society, and environment, where creating disorder in the higher levels of the hierarchy exacerbates problems down the chain, and vice versa (Griggs et al. 2013). This framework renders growth inefficient after a certain point, determined by the carrying capacity of the enterprises' support systems, illuminating that societal and environmental erosion undermines its long-term viability (Rees 2003). By rejecting the expansionist (cornucopian) economic assumptions, the examples suggest an **evasion of the conflict between economic development and environmental protection**.

Optimal scale

However, since even the circular economy unavoidably leads to perpetual growth (Zwier et al. 2015), and thereby destroys the finite, higher levels of the nested hierarchy, we argue for a **bio-inspired conception of economical systems**. They, as almost any other living organism on Earth, must have a limit, the optimal scale. An emergent feature of the case studies is that **optimal scale is something determined locally** relatively to particular ecological configuration and social situation, where both the ecological resources and social values determine the proper path for management. Using affordances provided by the local environment (Blok 2016), managers can evade opting for growth as a substitute for fair distribution.

A philosophical framework

Due to intertwined socio-economic-environmental spheres, ecological management is characterized by a holistic approach, where not only means but the ends of economic activity require philosophical reflection. Here, we adhere to the old idea that **economics is essentially a moral philosophy** (Daly & Farley 2010), and management a moral philosophy applied. If *anagnorisis* of sustainable development is the realization that the general economy is, as any other organism, analytically inseparable from its environment, then the nature of human predicament on a finite planet poses the following managerial problem: **what is the purpose of an economic enterprise?** What is the way to position a business towards the accelerating entropy problem and what is appropriate reaction to sudden awareness of the real situation, where traditional management actually increased chaos globally? The problem is as shocking in its Anthropocene scale as it is

surprising at what aspect it failed – abstractly speaking, at the autistic, GDP focus of classic economy (Daly & Farley 2010, pp. xxi), namely the abnormal subjectivity of the (financial) focus and (narrow) range of success-assessment.

Shared values

Correcting the widespread belief that greatest contributions to ecological sustainability may well come from efforts to reduce demand, above examples illustrate that the focus might actually be in **amending the production side by embedding it into natural processes and cycles**.² The philosophy of biomimicry provides a technological framework for this shift, conceptualizing the sustainable design, understood as nature-based technology (Blok & Gremmen 2016). Ecological management inherit the eco-centric orientation from philosophy of technology, where the human and earth agencies become intertwined (Blok 2017) – and management itself becomes a sort of natural-technological (and techno-social) hybrid. Since it is impossible to have technologies (or stories about them) without embedded values (Marshal & Lozeva 2009), managerial analysis ultimately comes down to the **problem of values and policies**, sullyng the ecological science with the uncertainties of the social sciences.

Education

Finally, all our examples illustrate a **managerial approach engaged in education** of both employees and customers. Together with communicational problem of identifying shared values, education proves to be potentially biggest disadvantage of ecological management, since its holistic approach, in sense of complexity of components and depth of analysis, makes far more **knowledge intensive management** than one traditionally conceptualized.

² To reduce demand, we need concrete and profitable models of ecological-production possibilities.