Norwegian and Romanian green cluster experiences for a digital era[1]

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Abstract

Addressing climate change through the reduction of fossil resources dependency requires the transition from fossil-based industrial production to a bio-based (green) industrial structure. The development of bio-based industry clusters might be part of the solution. This paper introduces the 'bioeconomy' concept and the Triple Helix model that are useful when examining the development of green industries clusters in the emerging digital era; the Smart City model might promote new ways to create profitable and sustainable businesses. Examples of good practices and clusters for green industries from Norway are provided and some success stories including Romanian firms are presented.

Keywords: *green industry, bioeconomy, bio-based industry cluster, triple helix model, smart cities, Romania*

[1] This paper presents some results of the Programme RO14 "Research within priority sectors" funded workshop *Joint partnerships in research and innovation focused on Triple Helix Model – Green Industries*
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***JEL codes**: L86, Q55, Q57*

1. The concept of *bioeconomy*[4]

Paul A. Samuelson, the *Father of Modern Economics* (Parker 2002, 25) called Romanian-born economist Nicholas Georgescu-Roegen "… a great mind… so far ahead of his time that he fails to get the recognition he deserves" (1999, xiii). Decades before the global concern about environmental destruction, Georgescu-Roegen proposed a new paradigm, 'the entropy economics', that acknowledges the economic process is an "irreversible process that admits no permanently renewable steady state for maintainable economic consumption" (Samuelson 1999, xiv).

Georgescu-Roegen (1975) advanced Lotka's (1956) idea that the socio-economy should be looked at as an expanded form of the human metabolism and introduced the concepts of 'exosomatic' metabolism (outside the human body) versus 'endosomatic' metabolism (inside the human body). Similar to the healthy functioning of a body when all of its organs are healthy, from a socioeconomic metabolic point of view, local sustainability is a prerequisite for achieving global sustainability. Nevertheless, in our interconnected world, local sustainability might not be achieved without a global exchange of knowledge.

Romania is a country endowed with a large variety of natural resources (forests, natural gas, fertile agricultural lands—7.5% of utilized agricultural area in EU—brown coal and lignite, crude oil, salt, mineral, silver, gold and hydrological networks). Georgescu-Roegen confesses in his memories (1976, xi) that what made him "look at the economic process from an unorthodox viewpoint is the particular nature of the economy of my native country, Romania… a struggling, overpopulated, peasant-dominated culture and economy." As a result, in the 1970s he advanced the idea of bioeconomics "as a discipline based on parallel knowledge and application of social, economic and biophysical principles and emphasized the importance of an understanding of the reciprocal influence of this principles" (Giampietro and Pastore 1999, 287) and warned "The term is intended to make us bear in

[4] Pauna et al. (2017, 113-114)

mind continuously the biological origin of the economic process and thus spotlight the problem of mankind's existence with a limited store of accessible resources, unevenly located and unequally appropriated" (Georgescu-Roegen1977, 361).

As a solution to modern world unsustainability conundrums, Georgescu proposed a minimal bioeconomic program required to build a sustainable world: "the complete prohibition of weapons production, in order to release productive forces for more constructive purposes; immediate aid to underdeveloped nations; gradual decrease in population to a level that could be maintained only by organic agriculture; avoidance, and strict regulation if necessary, of wasteful energy use; abandon our attachment to 'extravagant gadgetry'; 'get rid of fashion'; make goods more durable and repairable; and cure ourselves of workaholic habits by rebalancing the time spent on work and leisure, a shift that will become incumbent as the effects of the other changes make themselves felt." (Gowdy and Mesner 1998, 151).

In the past ten years, the OECD and the European Union made concerted efforts to politically implement a bioeconomy concept that is quite different from Georgescu-Roegen's and those differences might prove to be, in the near future, dangerous challenges. In their OECD 2009 report, Arundel and Sawaya (2009, 19) show how "The application of biotechnology to primary production, health and industry could result in an emerging "bioeconomy" where biotechnology contributes to a significant share of economic output. The bioeconomy … is likely to involve three elements: advanced knowledge of genes and complex cell processes, renewable biomass, and the integration of biotechnology applications across sectors." In 2011, the European Commission (EC) defined bio-based products as "products that are wholly or partly derived from materials of biological origin, excluding materials embedded in geological formations and/or fossilized". In 2012, it adopted the strategy for building a sustainable bioeconomy in the EU, where the term bioeconomy means "an economy using biological resources from the land and sea, as well as waste, as inputs to food and feed, industrial and energy production. It also covers the use of bio-based processes for sustainable industries." (EC, 2012).

The rest of the paper is organized as follows: Section 2 examines the concept of business clusters as agents for sustainable development in a digital era using the Nowegian case,

while Section 3 provides some examples of good practices and clusters for green industries in Norway and Romania.

2. Clusters for sustainability in a digital era

Almost two decades ago, Porter (1998, 78) was introducing clusters:

> Clusters are geographic concentrations of interconnected companies and institutions in a particular field. Clusters encompass an array of linked industries and other entities important to competition. They include, for example, suppliers of specialized inputs such as components, machinery, and services, and providers of specialized infrastructure. Clusters also often extend downstream to channels and customers and laterally to manufacturers of complementary products and to companies in industries related by skills, technologies, or common inputs. Finally, many clusters include governmental and other institutions—such as universities, standards-setting agencies, think tanks, vocational training providers, and trade associations—that provide specialized training, education, information, research, and technical support.

Pauna et al. (2012) explain how clusters work as instruments for promoting economic growth. They make the point that "model of industrial development based on regional (geographical) clusters comes into play as a reaction to the growing competition within global markets, but also for regaining the advantage of American and European industries that was lost in front of the Asian ones." European Commission promotes an initiative to support the European industry through excellence clusters which are driven by innovation.

2.1. Clusters, innovation and the Triple Helix model in Norway[5]

Smith and Leydesdorff (2014, 322) briefly present the evolution of the Triple Helix model (University-Industry-Government Relations):

> The Triple Helix thesis emerged in the mid-1990s, a time when universities and industry were exhorted by policy makers to work together more closely for the benefit of society resulting from the commercialisation of new knowledge (see for

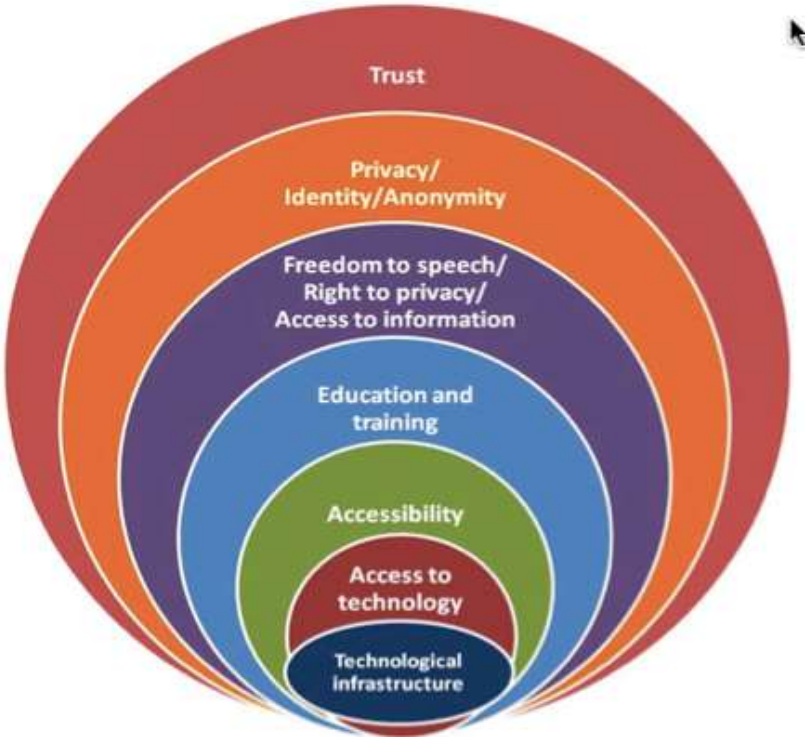
[5] Thomas Brekke (2017). *Green innovation and the triple-helix actors. HSN experience* presentation at *Joint partnerships in research and innovation focused on Triple Helix Model – Green Industries* Bucharest workshop.

example Branscomb 1993 on the US). The thesis became articulated as a confluence between Henry Etzkowitz' long-term interest in the study of university-industry relations and Loet Leydesdorff's interest in an evolutionary model in which there is an overlay of communications between different and independent spheres of activity. The first paper, Etzkowitz & Leydesdorff, (1995), The Triple Helix-University-Industry-Government Relations: A Laboratory for Knowledge-Based Economic Development came about after Etzkowitz' (1994) participation in a workshop in Amsterdam and an ensuing volume, entitled Evolutionary Economics and Chaos Theory: New Directions in Technology Studies (Leydesdorff & Van den Besselaar 1994). The metaphor of a Triple Helix emerged thereafter in discussions about organizing a follow-up conference under this title in Amsterdam in January 1996. Since then, Etzkowitz & Leydesdorff (2000) further elaborated the Triple Helix of University-Industry-Government Relations into a model for studying both knowledge-based and developing economies. Over time the model has evolved, been re-interpreted and critiqued (e.g., Carayannis & Campbell, 2009; Cooke & Leydesdorff, 2006; Lawton Smith & Ho, 2006; Shinn, 2002).

The Norwegian government appointed twelve strong clusters consisting of world class enterprises in their field. The clusters have been selected in strong competition with several expert environments in Norway. The cluster focus spans from aquaculture and culinology through cancer treatment subsea and maritime technologies and to Micro- and Nanotechnology. There is great diversity between the different clusters, however, for the common factors and challenges there are special actions to support and develop the program and its participating clusters through international-level best practice. A triple helix model example has the University College of Southeast Norway (abbreviated HSN) as the anchor institution providing the region with high quality teaching, research and innovation development capacities; Electronic Coast is the cluster of electronic- and ICT-based companies in Vestfold, while MicroTech Innovation (MTI) is the independent company coordinating micro- and nanotechnology cluster development efforts.

2.2. Smart Cities model and how to create profitable, sustainable businesses[6]

Smart city is a concept with many definitions but most definitions include the use of computer technology. The main objective is to improve quality of life for its citizens through better services, lower environmental footprint, sustainability and last but not least to facilitate citizen participation. In Fig. 1 are listed the prerequisites for Smart Cities.



Source: Berntzen, L. & Karamagioli (2010) https://www.semanticscholar.org/paper/Regulatory-Measures-to-Support-eDemocracy-Berntzen-Karamagioli/f2e2e03837060fc02ac68f32d5fda231ea4b4da0

Figure 1 Prerequisites for Smart Cities

Stakeholders are the citizens, businesses (local, national and international), city administration, politicians (local government), the national government and its agencies. The application areas are communication; culture; energy; environment/climate; emergency services; health, safety and security; tourism; transport; work. From a business perspective it is necessary to understand the value chains of the smart city, find new ways of value generation and distribution and develop multiple value chains, and often complex ones.

[6] Lasse Berntzen (2017). *Business Perspectives on Smart Cities—Opportunities for Companies* presentation at *Joint partnerships in research and innovation focused on Triple Helix Model – Green Industries* Bucharest workshop.

3. Examples of good practices and clusters for green industries: Norway and Romania

Norwegian success stories including Romanian firms[7] arise from practical experience with EEA/EC projects such as MEDICARE MEMSCAP-EUROMEDICA IASI; GREENCARE TRILOBITE-MICROELECTRONICA Bucharest (green industry and water care); HASTAC EC FP 6 (MEMSCAP, aerospace, Jet engine emissions-environment); HISVESTA EC FP7 (MEMSCAP, altimetry improvements-safety).

The list of Romanian cluster initiatives for bio-based industries and their respective development stage includes: PROWOOD (primary biomass sector)/Maturity stage; Green Energy (renewable energies)/Maturity stage; IndAgro Pol (food & feed)/Maturity stage; ETREC (automotive)/Take off stage; ASTRICO NE (textile)/Maturity stage; ELINCLUS (automotive) – Maturity stage; ROSENC (Renewable energies)/Maturity stage; Traditions Manufacture Future (textile)/Take off stage; REGIOFA (primary biomass sector)/Take off stage; Romanian Textile Concept (textile)/Maturity stage; Transylvanian Furniture Cluster (primary biomass sector)/Maturity stage; AgrooFood Regional Cluster (food & feed)/Take off stage; Agro Transylvania (food & feed)/Maturity stage; MECHATREC (automotive)/Take off stage; Transylvanian Textile and Fashion (textile)/Take off stage; Builders Guild Iasi (eco construction)/Initial stage; Construct Cluster Oltenia (eco construction)/Take off stage; Advertise Printing Packaging (pulp & paper)/Take off stage; BIOGAS INNO (renewable energies)/Initial stage; Green Solutions Lower Danube (renewable energies)/Take off stage; TREC (renewable energies)/Take off stage; ACAROM (automotive)/Take off stage; START Innovation (renewable energies)/Initial stage; BIODANUBIUS (renewable energies)/Initial stage; ECOIND (renewable energies)/Initial stage; INOMAR (renewable energies)/Initial stage; and last but not least Transylvanian Mechanical Engineering (automotive)/Initial stage.

More than a third of those clusters could be considered as key drivers or pioneers in the bio-economy in Romania. Romania's green industries strengths are Primary biomass, Food

[7] Ole Henrik Gusland (2017). *Opportunities for collaboration* and *Practical experience in building a strong project* presentations at *Joint partnerships in research and innovation focused on Triple Helix Model – Green Industries* Bucharest workshop.

& Feed and Renewable Energy, while opportunities are in Phyto-pharmaceuticals, Textile & Clothing, Eco-Construction and Human resource.

Acknowledgement

Raluca-Ioana Iorgulescu is grateful for the opportunity to participate in the workshop 'Joint partnerships in research and innovation focused on Triple Helix Model – Green Industries'. This experience was helpful for advancing her research on *flow-fund modeling of the socioeconomic metabolism*.

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